Option 11 & Meridian 1

Intelligent Peripheral Equipment Circuit Cards for CIS

Description and installation

P0 Number: P0875866
Document Release: Standard 3.00
Date: October 1997

© 1995,1997
All rights reserved

Printed in Canada

Information is subject to change without notice. Northern Telecom reserves the right to make changes in design or components as progress in engineering and manufacturing may warrant. This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC rules, and the radio interference regulations of Industry Canada. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy, and if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at their own expense.

SL-1 and Meridian 1 are trademarks of Northern Telecom.

Revision history

October 1997

Issue 3.00 released as Standard for Generic X11 Release 23.0x.

January 1996

Standard, release 2.00

July 1995

Provisional, release 1.0

Contents

About this document ix

CIS Analog CO Trunk — NT5K60/61 and QPC661 1

Operating parameters 2

Feature interactions 3

Packaging 7

Implementation 8

Connection Tables 25

Technical description 31

CIS Digital CO Trunk — NTCG01/02 33

Operating parameters 34

Feature interactions 35

Software packaging 37

Feature implementation 38

Connection Tables 53

Technical description 57

E&M TIE trunk circuit card — NT5K83 63

Functional description 63

Physical description 64

Technical description 79

Trunk types description 80

Tone detector circuit card — NT5K48 89
Functional description 89
Physical description 90
Technical description 90

Digital Line Card — NT8D02 95
Description 95
Technical summary 97

Analog Message Waiting Line Card — NT8D09 99
Description 99
Technical summary 101

Universal Trunk Card — NT8D14 105
Functional description 105
Application 112

XMFC/MFE card — NT5K21 115
Overview 115
MFC signaling 115
MFE signaling 118
Sender and receiver mode 119
Physical specifications 123

CIS Multifrequency Shuttle 125
Operating parameters 132
Feature interactions 133
Feature packaging 135
Feature implementation 136
Feature operation 139

About this document

This document describes the functions and applications of the following circuit cards that are available for use in the Commonwealth of Independent States (CIS), (formerly USSR):

- NT8D02 analog line card
- NT8D09 digital line card
- NT8D14 universal trunk card
- NT5K21 R2MFC circuit card
- QPC661 mother board plus 44.71044.007 daughter board (for EPE analog incoming local trunk)
- QPC661 mother board plus 44.71045.006 daughter board (for EPE analog incoming toll trunk)
- QPC661 mother board plus 44.71046.005 daughter board (for EPE analog outgoing trunk)
- NT5K60AA CIS IPE analog incoming local and toll trunk card
- NT5K61AA CIS IPE analog outgoing trunk card
- NTCG01AA CIS digital trunk (large systems)
- NTCG02AA CIS digital trunk (small systems)
- NT5K83BA E&M TIE trunk circuit card
- NT5K48AB tone detector circuit card

The above cards were introduced as part of the X11 Release 21 software program.

With X11 Release 23, the CIS Multifrequency Shuttle (CIS MF Shuttle) feature was added to this document.

CIS Analog CO Trunk — NT5K60/61 and QPC661

Three Wire Analog Trunks for the Commonwealth of Independent States (CIS) provide the connectivity between the Meridian 1 and the three-wire analog trunks (3WT) used in the CIS. Analog incoming local three-wire trunks, analog incoming toll three-wire trunks, and analog outgoing three-wire trunks can be connected to the Meridian 1.

The following hardware cards are supported:

— Cards supported in an Enhanced Peripheral Equipment (EPE) environment are referred to as E3W cards. Equipment practice employed for all three trunks is the same, a trunk pack mother board (QPC661) in association with a daughter board. They consist of:

- Daughter board 44.71044.007 for incoming local calls
- Daughter board 44.71045.006 for incoming toll calls
- Daughter board 44.71046.005 for outgoing local and toll calls

— Cards supported in an Intelligent Peripheral Equipment (IPE) environment are referred to as X3W cards. They consist of:

- NT5K60AA for incoming local and toll calls
- NT5K61AA for outgoing local and toll calls

The following functions are provided by the Three-Wire Analog Trunk – CIS cards:

— Delivery of Automatic Number Identification (ANI) on request from the Public Exchange/Central Office for outgoing 3WT analog calls

— Downloading of specific transmission parameters (i.e., pad data, public network toll access code, and hardware ID) for X3W cards, and

— Provision of dial tone internally by the Meridian 1 to the originator of the call after seizure of an outgoing X3W trunk.

The trunk state change validation timing is performed by the 3WT cards. For 3WT trunks, the originating party controls the disconnection of a call. When the originating party goes on-hook, the call is released. Note, however, that when Malicious Call Trace is enabled, the Local Exchange may require a two-way release. This two-way release applies only on a set.

A 3WT Unproductive Timer is used to prevent a call on a X3W trunk from remaining unanswered for too long. This timer is set to 10 minutes.

For outgoing calls, digits are sent from the main Central Processing Unit (CPU) to the 3WT firmware. This is done by Dual-tone Multifrequency (DTMF) signaling for E3W equipment, and by IPE messaging for X3W equipment. The firmware then sends the digits as pulses and controls the actual decadic outpulsing.

Digits for incoming calls are received by the 3WT firmware as pulses. For E3W equipment, each valid pulse is reported to the main CPU by Scan and Signaling Distributor (SSD) messages. For X3W equipment, the pulses are collected by firmware and complete digits are reported to the main CPU as IPE digit messages.

Operating parameters

X3W trunk cards can only be configured on IPE shelves; E3W trunk cards can only be configured on EPE shelves.

Trunk-to-trunk connections are supported, but the ANI information will refer to the ANI DN of the incoming route, except with QSIG, Q931, and Digital Private Signaling System #1 (DPNSS1) routes. QSIG, BRI and Q931 ANI information will use the Calling Line Identification (CLID) information, whereas DPNSS1 ANI will use the Originating Line Identifier (OLI) information if this information is present.

Dynamic Loss Switching is not supported, because there is no connection matrix and loss alternative table available for the CIS market.

The Static Loss Plan Download (SLPD) is supported on X3W trunks. The table may be configured in overlay 97.

No loss downloading/switching is done for E3W trunks.

ANI is only supported for outgoing calls.

The data in ANI is built only once at the beginning of the call. Once the trunk access code is dialed, the ANI information is downloaded to the 3WT firmware. The download of ANI occurs only once and is not changed or redownloaded for any kind of operation during a call; therefore, if the call goes through any type of modification, such as a transfer or call forward for instance, the ANI information sent (when requested) is that of the originator of the call.

Toll Operator Manual Ringing and Break-In are not supported on IPE analog trunks.

Data calls are supported, but with the limitations due to the 500 Hz ANI requests that can happen any time during the call and the ANI information being sent on the same voice circuit on which the data is being transmitted; therefore, the transmission of data is not guaranteed.

Multifrequency Shuttle signaling is not supported on either X3W or E3W trunk cards.

EPE interfaces cannot be used on the Option 11.

The CIS A-law XCT (NTD17AE) is required.

Feature interactions

Authorization Code

An extension may, referring to the Authorization Code, seize an outgoing CIS 3WT trunk. The Authorization Code category is used to build the ANI message, meaning that a set which has a CLS restricting call category can complete a call to the public network using the Authorization Code.

Autodial

Autodial on a E3W trunk will fail for toll calls. The reason is that E3W trunks do not wait for the ANI request from the Public Exchange/Central Office, which is expected to appear after the toll access code is dialed. The Public Exchange then does not accept the call due to failure to receive ANI information.

Dial Tone Detection

Dial Tone detectors are supported with the limitations of the reliability of the tone provided by the Public Exchange.

DPNSS1 Gateway

The ANI information transmitted for this incoming DPNSS1 route will include the Local Exchange Code (LEC) of the CIS outgoing route, the ANI DN, and the Category Code (CAC) of this incoming route.

The ANI DN information which is built will refer to the Originating Line Identifier (OLI) if present and the Route DN Length prompt for ANI (RDNL ≠ 0) in LD 16. If the OLI is available, but RDNL = 0 for that route, the ANI DN is the ANI DN of that incoming route. If the OLI is available, but RDNL = 0 and the ANI DN of the incoming route is not defined, the ANI DN is the ANI DN of the CIS outgoing route. If the OLI is available, but RDNL = 0, and the ANI DN of the incoming route is not defined, and the ANI DN of the CIS outgoing route is not defined, the ANI DN will be built with the Additional Digit (ADDG). If RDNL ≠ 0, its value will be the number of digits extracted from the OLI to be used as the ANI DN. The least significant digit of the OLI will be extracted (e.g., if the DN is 4201, the 1 is the least significant digit).

If there is no OLI, the ANI DN of the DPNSS1 route is used to build the ANI message. If there is no ANI DN on the DPNSS1 route, the ANI DN of the CIS outgoing route is used to build the ANI message. If there is no ANI DN on the CIS outgoing route, the ANI is built with the ADDGs of the CIS route (ADDG is always defined).

Incoming Digit Conversion

The construction of an ANI message does not care if Incoming Digit Conversion is used. The DN sent as ANI is the actual DN of the set, not necessarily the DID number to dial to reach the set. Therefore, if an external party uses a DN for making a call to the corresponding extension which is delivered in an ANI message, the call may fail.

Last Number Redial

Last Number Redial on an E3W trunk will fail for toll calls. The reason is that E3W trunks do not wait for the ANI request from the Public Exchange, that is expected to appear after the toll access code is dialed. The Public Exchange will not accept the call due to the failure to receive ANI information.

Multiple Appearance DNs

Since the ANI category is defined on a per set basis, two stations with the same multiple Appearance DN can be assigned different ANI categories.

Q931 Gateway/BRI Gateway

The ANI information transmitted for this incoming Q931 route will include the LEC of the CIS outgoing route, the ANI DN, and the CAC of this incoming route.

The ANI DN information which is built will refer to the Calling Line Identification (CLID) if present and the Route DN Length prompt for ANI (RDNL ≠ 0) in LD 16. If the CLID is available but RDNL = 0 for that route, the ANI DN is the ANI DN of that incoming route. If the CLID is available, but RDNL = 0, and the ANI DN of the incoming route is not defined, the ANI DN is the ANI DN of the CIS outgoing route. If the CLID is available, but RDNL = 0, and the ANI DN of the incoming route is not defined, and the ANI DN of the CIS outgoing route is not defined, the ANI DN will be built with the ADDG. If RDNL ≠ 0, its value will be the number of digits extracted from the CLID to be used as the ANI DN. The least significant digits of the CLID will be extracted (e.g., if the DN is 4201, the 1 is the least significant digit).

If there is no CLID, the ANI DN of the Q931 route is used to build the ANI message. If there is no ANI DN on the Q931 route, the ANI DN of the CIS outgoing route is used to build the ANI message. If there is no ANI DN on the CIS outgoing route, the ANI is built with the ADDG of the CIS outgoing route (ADDG is always defined).

QSIG Gateway

The ANI information transmitted for this incoming QSIG route will include the LEC of the CIS outgoing route, the ANI DN, and the CAC of this incoming route.

The ANI DN information which is built will refer to the Calling Line Identification (CLID) if present and the Route DN Length prompt for ANI (RDNL ≠ 0) in LD 16. If the CLID is available but RDNL = 0 for that route, the ANI DN is the ANI DN of that incoming route. If the CLID is available, but RDNL = 0, and the ANI DN of the incoming route is not defined, the ANI DN is the ANI DN of the CIS outgoing route. If the CLID is available, but RDNL = 0, and the ANI DN of the incoming route is not defined, and the ANI DN of the CIS outgoing route is not defined, the ANI DN will be built with the ADDG. If RDNL ≠ 0, its value will be the number of digits extracted from the CLID to be used as the ANI DN. The least significant digits of the CLID will be extracted (e.g., if the DN is 4201, the 1 is the least significant digit).

If there is no CLID, the ANI DN of the QSIG route is used to build the ANI message. If there is no ANI DN on the QSIG route, the ANI DN of the CIS outgoing route is used to build the ANI message. If there is no ANI DN on the CIS outgoing route, the ANI is built with the ADDG digits of the CIS outgoing route (ADDG is always defined).

The ANI information transmitted for this incoming QSIG route will include the LEC of the CIS outgoing route, the ANI DN, and the CAC of this incoming route.

R2MFC Calling Number Identification

The incoming R2MFC will be tandemed if the call is outgoing to a CIS trunk, however, the CNI information will not be transported across the gateway. The ANI built will be the LEC of the outgoing CIS route, the ANI DN of this R2MFC incoming route if defined (otherwise it will be the ANI DN of the outgoing CIS route, or the ADDG digit), and the CAC of this incoming R2MFC route.

The category (CAC) used to build the R2MFC Calling Number Identification (CNI) for the analog, digital and Basic Rate Interface (BRI) sets is also used to build the CIS ANI. The meaning of CAC is different between the R2MFC CNI signaling and the CIS signaling (CIS analog trunks and CIS digital trunks). R2MFC CAC prompt values are in the range of 0 to 10, and the default is 0. CIS CAC prompt values are in the range of 0 to 9, and the default value is 3.

If the MFC package is equipped, but not the CIST package, the CAC prompt uses the R2MFC range and default. If the CIST package is equipped (MFC package equipped or not) the CAC prompt uses the CIS range and default.

> ***Note:*** If the system is equipped with both CIS and R2MFC trunks, a Common Category (CAC) is used for both signal types. The Category prompt is set to the default value for the CIS trunk, not to that of the R2MFC trunk.

Speed Call

Speed Call on an E3W trunk will fail for toll calls. E3W trunks do not wait for the ANI request from the Public Exchange, that is expected to appear after the toll access code is dialed. The Public Exchange will not accept the call due to the failure to receive ANI information.

Virtual Network Services

Virtual Network Services is not supported on CIS trunks.

Packaging

The Three-Wire Analog Trunk – CIS software is contained in Commonwealth of Independent States Trunk Interface (CIST) package 221.

The following packages are also required:

— Fast Tone and Digit Switch (FTDS) package 87 (only for E3W cards)

— Flexible Tones and Cadences (FTC) package 125

— International Supplementary Features (SUPP) package 131 for DID/DOD

— Flexible Numbering Plan (FNP) package 160

— Trunk Failure Monitor (TFM) package 182, and

— Meridian 1 Extended Peripheral Equipment (XPE) package 203 (only for X3W cards).

Implementation

This is an example that describes how the 3WT related features are configured. Only the prompts that are significant for the Three-Wire Analog Trunk – CIS feature are mentioned.

The following features are needed to make the feature work according to this example: B34 Codec Static Loss Plan Downloading; Partial Dial Timer; End-of-Selection Busy; Tone to-Last Party; Special Dial Tones After Dialed Numbers; Trunk Barring, and Special Service List.

Table 1
LD 17 – Configure the system data.

Prompt	Response	Description
REQ	NEW, CHG	Add, or change.
...		
PARM	YES	Change system parameters.
PCML	A	System Pulse Code Modulation companding law. A-law is to be used in the CIS market.
...		
DTRB	70	Dual-tone Multifrequency burst and interdigit pause for the Tone and Digit Switch. Pulse/Pause Ratio 70/70. For outgoing E3W cards, the preferable digitone burst time is 70 ms.

Table 2
LD 16 – Configure an incoming X3W DID route.

Prompt	Response	Description
REQ	NEW, CHG	Add, or change.
TYPE	RDB	Route Data Block.
...		
TKTP	DID	Direct Inward Dialing trunk data block.
...		
DTRK	NO	This is not a digital trunk route.
...		
ICOG	ICT	Incoming trunk.
...		
CNTL	YES	Change control or timers.
- TIMR	ICF 0	Incoming flash timer should be set to 0. Validation is performed by 3WT firmware.
- TIMR	EOD 13952	End of dial timer, default value in milliseconds.
- TIMR	DSI 11904	Disconnect supervision timer in milliseconds.
- TIMR	DDL 0	Delay Dial Timer not needed.
- TIMR	GTI 128	Incoming guard timer, in milliseconds.
...		
NEDC	ORG	Near End Disconnect Control. Originating end control.
FEDC	ORG	Far End Disconnect Control. Originating end control.
CDPC	(NO)	Meridian 1 is not the controlling party on incoming calls.
...		
OPR	(NO)	This is not an outpulsing route.

Prompt	Response	Description
PRDL	YES	Partial dial timing is equipped using EOD.
EOS	BSY	Busy signal is sent on time-out.
DNSZ	(0)–7	Number of digits expected on DID routes. 0, the default, indicates no fixed value. This value must be defined according to the numbering plan.
...		
BTT	30	Busy Tone Time. Length of Busy/overflow to be returned on DID routes in seconds.
...		
CAC	0–(3)–9	Route ANI category.
ANDN	0–9999999	Route ANI DN.
RDNL	0–(4)–7	Route DN Length for ANI. This is printed for DPNSS1, MCDN, and QSIG routes only.

Table 3
LD 16 – Configure an outgoing X3W DID route and define the toll digit using the TDG prompt.

Prompt	Response	Description
REQ	NEW, CHG	Add, or change.
TYPE	RDB	Route Data Block.
...		
TKTP	DID	Direct Inward Dialing trunk data block.
...		
DTRK	NO	This is not a digital trunk route.
...		
ICOG	OGT	Outgoing trunk.

Prompt	Response	Description
...		
CNTL	YES	Change control or timers.
- TIMR	ATO 7936	ANI Timeout timer, in milliseconds.
- TIMR	OGF 0	Outgoing flash timer should be set to 0 in milliseconds. Validation will be done by 3WT firmware.
- TIMR	EOD 13952	End of dial timer, default value.
- TIMR	DSI 11904	Disconnect supervision timer.
- TIMR	DDL 0	Delay Dial Timer not needed.
- TIMR	GTO 2944	Outgoing guard timer.
...		
NEDC	ETH	Near End Disconnect Control Either end control.
FEDC	ETH	Far End Disconnect Control Either end control.
...		
NATL	NO	North American Toll scheme.
TDG	8	Toll Digits. List of digits after trunk access code which indicate toll calls.
...		
OPR	(NO)	This is not an outpulsing route.
...		
ACKW	(NO)	Seizure acknowledge signal is not expected.
...		
LEC	0–9999999	Local Exchange Code. A value must be entered.
ADDG	0–(8)–9	Additional digit.
CAC	0–(3)–9	Route ANI category.

Prompt	Response	Description
ANDN	0–9999999	Route ANI DN.
RDNL	0–(4)–7	Route DN Length for ANI. This is printed for DPNSS1, MCDN, and QSIG routes only.

Table 4
LD 18 – Configure the Special Service List.

Prompt	Response	Description
REQ	NEW, CHG	Add, or change.
TYPE	SSL	Special Service List data block.
CUST	0–99	Customer number.
SSL	1–15	List number for Special Service List.
SSDG	xxxx	Special Service Digit or Digits (1–4 digits).
...		
- TOLL	YES	The SSDG entry is a toll number.
...		
SSDG	xxxx	Special Service Digit or Digits (1–4 digits).
...		
- SSUC	YES	The SSDG entry is a Special Service unanswered call.
SSDG	<CR>	

Table 5
LD 16 – Configure an outgoing X3W DID route and define the toll access code using the SSL prompt.

Prompt	Response	Description
REQ	NEW, CHG	Add, or change.
TYPE	RDB	Route Data Block.
...		
TKTP	DID	Direct Inward Dialing trunk data block.
...		
DTRK	NO	This is not a digital trunk route.
...		
ICOG	OGT	Outgoing trunk.
...		
CNTL	YES	Change control or timers.
- TIMR	ATO 7936	ANI Timeout timer, in milliseconds.
- TIMR	OGF 0	Outgoing flash timer should be set to 0 in milliseconds. Validation will be done by 3WT firmware.
- TIMR	EOD 13952	End of dial timer, default value.
- TIMR	DSI 11904	Disconnect supervision timer.
- TIMR	DDL 0	Delay Dial Timer not needed.
- TIMR	GTO 2944	Outgoing guard timer.
NEDC	ETH	Near End Disconnect Control Either end control.
FEDC	ETH	Far End Disconnect Control Either end control.
...		
SSL	1	Special Service List number.
...		

Prompt	Response	Description
LEC	0–9999999	Local Exchange Code.
ADDG	0–(8)–9	Additional digit.
CAC	0–(3)–9	Route ANI category.
ANDN	0–9999999	Route ANI DN.

Table 6
LD 16 – Configure an incoming E3W DID route.

Prompt	Response	Description
REQ	NEW, CHG	Add, or change.
TYPE	RDB	Route Data Block.
...		
TKTP	DID	Direct Inward Dialing trunk data block.
...		
DTRK	NO	This is not a digital trunk route.
...		
ICOG	ICT	Incoming trunk.
CNTL	YES	Change control or timers.
- TIMR	EOD 13952	End of dial timer, default value.
- TIMR	DSI 11904	Disconnect supervision timer.
- TIMR	DDL 0	Delay Dial Timer not needed.
...		
NEDC	ORG	Near End Disconnect Control Originating end control.
FEDC	ORG	Far End Disconnect Control Originating end control.
CDPC	(NO)	Meridian 1 is not the controlling party on incoming calls.

Prompt	Response	Description
...		
OPR	(NO)	This is not an outpulsing route.
PRDL	YES	Partial dial timing is equipped using EOD.
EOS	BSY	End of selection and busy signals enabled.
DNSZ	(0)–7	Number of digits expected on DID routes. 0, the default, indicates no fixed value. This value must be defined according to the numbering plan.
...		
BTT	30	Length of busy/overflow tone to be returned on DID routes in seconds.
...		
CAC	0–(3)–9	Route ANI category.
ANDN	0–9999999	Route ANI DN.

Table 7
LD 16 – Configure an outgoing E3W COT route.

Prompt	Response	Description
REQ	NEW, CHG	Add, or change.
TYPE	RDB	Route Data Block.
...		
TKTP	COT	Central Office Trunk data block.
...		
DTRK	NO	This is not a digital trunk route.
...		
ICOG	OGT	Outgoing trunk.

Prompt	Response	Description
...		
CNTL	YES	Change control or timers.
- TIMR	EOD 13952	End of dial timer, default value.
- TIMR	DSI 11904	Disconnect supervision timer.
- TIMR	DDL 0	Delay Dial Timer not needed.
- TIMR	GTO 2944	Outgoing guard timer.
...		
NEDC	ETH	Near End Disconnect Control Either end control.
FEDC	ETH	Far End Disconnect Control Either end control.
CDPC	(NO)	Meridian 1 is not the controlling party on incoming calls.
...		
NATL	NO	North American Toll scheme.
...		
LEC	0–9999999	Local Exchange Code.
ADDG	0–(8)–9	Additional digit.
CAC	0–(3)–9	Route ANI category.
ANDN	0–9999999	Route ANI DN.

Table 8
LD 14 – Add or change trunk data for X3W incoming DID trunk.

Prompt	Response	Description
REQ	NEW, CHG	Add, or change.
TYPE	DID	Direct Inward Dialing trunk data block.
...		
XTRK	XDID	Extended Trunk Type. IPE DID trunk card.
...		
SIGL	CIS	Trunk Signaling. Three-wire CIS trunk signaling.
CIST	(NO),YES	Prompted only for incoming routes (i.e., ICOG = ICT). NO = Local trunk. YES = Toll trunk.
...		
STRI	IMM	Immediate incoming start arrangement.
...		
SUPN	YES	Answer and disconnect supervision required.
CLS	(DIP)	Dial pulse (for 3WT incoming and outgoing).
	(SHL), LOL	Line length used for B34 Codec settings.
	(BARD), BARA	Barring (denied) allowed.

Table 9
LD 14 – Add or change trunk data for X3W outgoing DID trunk.

Prompt	Response	Description
REQ	NEW, CHG	Add, or change.
TYPE	DID	Direct Inward Dialing trunk data block.
...		

Prompt	Response	Description
XTRK	XDID	IPE DID trunk card.
...		
SIGL	CIS	Three-wire CIS trunk signaling.
...		
STRO	IMM	Immediate outgoing start arrangement.
...		
SUPN	YES	Answer and disconnect supervision required.
CLS	(DIP)	Dial pulse (for 3WT incoming and outgoing).
	(SHL), LOL	Line length used for B34 Codec settings.
	(BARA), BARD	Barring (allowed) denied.

Table 10
LD 14 – Add or change trunk data for E3W incoming three-wire trunk.

Prompt	Response	Description
REQ	NEW, CHG	Add, or change.
TYPE	DID	Direct Inward Dialing trunk data block.
...		
SIGL	EAM	Ear &mouth.
CDEN	DD	Double density.
...		
STRI	IMM	Immediate incoming start arrangement.
...		
SUPN	YES	Answer and disconnect supervision required.

Prompt	Response	Description
CLS	(DIP)	Dial pulse.

Table 11
LD 14 – Add or change trunk data for E3W outgoing three-wire trunk.

Prompt	Response	Description
REQ	NEW, CHG	Add, or change.
TYPE	COT	Central Office Trunk data block.
...		
SIGL	LOP	Loop start.
CDEN	DD	Double density.
...		
SUPN	YES	Answer and disconnect supervision required.
- STYP	PSP	Polarity sensitive card.
...		
SEIZ	YES	Answer and disconnect supervision required.
CLS	(DIP)	Dial pulse.

Table 12
LD 10 – Add or change PBX telephones for CIS.

Prompt	Response	Description
REQ	NEW, CHG	Add, or change.
TYPE	500	PBX (500/2500) telephone data block.
...		
CLS	(DNAA), DNAD	DN of set (allowed) denied for use in ANI messages.
CAC	0–9	Specifies ANI category for 3WT calls.

Table 13
LD 11 – Add or change BCS telephones for CIS.

Prompt	Response	Description
REQ	NEW, CHG	Add, or change.
TYPE	aaaa	Telephone type, where: aaaa = SL1, 2006, 2008, 2009, 2016, 2018, 2112, 2216, 2317, 2616, or 3000.
...		
CLS	(DNAA), DNAD	DN of set (allowed) denied for use in ANI messages.
CAC	0–9	Specifies ANI category for 3WT calls.

Table 14
LD 12 – Add or change an Attendant Console for CIS.

Prompt	Response	Description
REQ	NEW, CHG	Add, or change.
TYPE	ATT, 1250, 2250	Console type.
...		

Prompt	Response	Description
CLS	(DNAA), DNAD	DN of set (allowed) denied for use in ANI messages.
CAC	0–9	Specifies ANI category for 3WT calls.

Table 15
LD 27 – Add or change BRI sets for CIS.

Prompt	Response	Description
REQ	NEW, CHG	Add, or change.
TYPE	DSL	Digital Subscriber Loop data block.
...		
CLS	(DNAA), DNAD	DN of set (allowed) denied for use in ANI messages.
CAC	0–9	Specifies ANI category for 3WT calls.

Table 16
LD 56 – Configure dial tone, busy tone, and tone to last party.

Prompt	Response	Description
REQ	NEW, CHG, PRT	Add, change, or print.
TYPE	MCAD	Master Cadence data block.
WACD	30	Cadence number. In this example entry 30 is modified.
CDNC	60 60	On-off phases for cadence.
REQ	NEW, CHG, PRT	Add, change, or print.
TYPE	FCAD	Firmware Cadence data block.
WACD	30	Cadence number. In this example entry 30 is modified.
CDNC	60 60	On-off phases for cadence. 0.3 second on, 0.3 second off.
END	REPT	Repeating cycles.

Prompt	Response	Description
- CYCS	1	On/off cycles to be repeated.
- WTON	YES	Define tones associated with the cadence.
- - TONES	158	420 Hz and -12 dB below overload.
REQ	NEW, CHG, PRT	Add, change, or print.
TYPE	FTC	Flexible Tones and Cadences data block. Used to provide special dial tone after dialed number.
...		
HCCT	YES	Hardware Controlled Cadences and Tones modification of the hardware.
...		
- BUSY		Busy tone.
- - TDSH		
- - XTON	158	420 Hz and -12 dB below overload.
- - XCAD	30	XCT cadence number. 0.3 seconds on, 0.3 seconds off.
...		
- TLP		Tone to last party.
-- TDSH		
- - XTON	158	420 Hz and -12 dB below overload.
- - XCAD	30	XCT cadence number. 0.3 seconds on, 0.3 seconds off.
- TLTP	30	Tone to last party timer in seconds.
...		
SRC	YES	Source Tones.

Prompt	Response	Description
- SRC1		CIS continuous dial tone within the range.
- - TDSH		
- - XTON	158	420 Hz and -12 dB below overload.
- - XCAD	0	No cadence.
REQ	NEW, CHG, PRT	Add, change, or print.
TYPE	DTAD	Special Dial Tone After Dialed Number data block.
DDGT	9	The digit 9 is to be used as an outgoing local access code.
TONE	SRC1	Tone to be provided after the dialed digit 9.

Table 17
LD 88 – Configure the Authcode data block.

Prompt	Response	Description
REQ	NEW, CHG	Add, or change.
TYPE	AUB	Authcode data block.
...		
CLAS	(0)–115	Classcode value assigned to Authcode (NAUT).
...		
NCOS	(0)–99	Network Class of Service Group number.
CAC	0–9	Specifies ANI category for CIS calls.

Table 18
LD 97 – Configure the Loss Plan table for CIS.

Prompt	Response	Description
REQ	CHG	Change.
TYPE	LOSP	Loss Plan Tables. Configure loss parameters for downloading.
...		
TTYP	(STAT)	Install a B34 Static Loss Plan Table.
- STYP	(PRED)	A numbered predefined table is to be used.
- - TNUM	28	28 = “Existing” CIS Table.

Connection Tables

Table 19
NT5K60 and NT5K61 Analog CO Trunk connections for NT8D37 I/O panel connectors A, E, K, R

Lead Designations	Pin Numbers	Pair Colour	I/O Panel connector				Unit Number
COT			A	E	K	R	
AO BO	26 1	W-BL BL-W	SLOT 0	SLOT 4	SLOT 8	SLOT 12	Unit 0
CO Spare	27 2	W-O O-W					
A1 B1	28 3	W-G G-W					Unit 1
C1 Spare	29 4	W-BR BR-W					
A2 B2	30 5	W-S S-W					Unit 2
C2 Spare	31 6	R-BL BL-R					
A3 B3	32 7	R-O O-R					Unit 3
C3 Spare	33 8	R-G G-R					
A4 B4	34 9	R-BR BR-R					Unit 4
C4 Spare	35 10	R-S S-R					
A5 B5	36 11	BK-BL BL-BK					Unit 5
C5 Spare	37 12	BK-O O-BK					
A6 B6	38 13	BK-G G-BK					Unit 6
C6 Spare	39 14	BK-BR BR-BK					
A7 B7	40 15	BK-S S-BK					Unit 7
C7 Spare	41 16	Y-BL BL-Y					

Table 20
NT5K60 and NT5K61 Analog CO Trunk connections for NT8D37 I/O panel connectors B, F, L, S (Part 1 of 2)

Lead Designations	Pin Numbers	Pair Colour	I/O Panel connector				Unit Number
COT			B	F	L	S	
AO BO	26 1	W-BL BL-W	SLOT 1	SLOT 5	SLOT 9	SLOT 13	Unit 0
CO Spare	27 2	W-O O-W					
A1 B1	28 3	W-G G-W					Unit 1
C1 Spare	29 4	W-BR BR-W					
A2 B2	30 5	W-S S-W					Unit 2
C2 Spare	31 6	R-BL BL-R					
A3 B3	32 7	R-O O-R					Unit 3
C3 Spare	33 8	R-G G-R					
A4 B4	34 9	R-BR BR-R					Unit 4
C4 Spare	35 10	R-S S-R					
A5 B5	36 11	BK-BL BL-BK					Unit 5
C5 Spare	37 12	BK-O O-BK					
A6 B6	38 13	BK-G G-BK					Unit 6
C6 Spare	39 14	BK-BR BR-BK					
A7 B7	40 15	BK-S S-BK					Unit 7
C7 Spare	41 16	Y-BL BL-Y					

Table 20
NT5K60 and NT5K61 Analog CO Trunk connections for NT8D37 I/O panel connectors B, F, L, S (Part 2 of 2)

Lead Designations	Pin Numbers	Pair Colour	I/O Panel connector				Unit Number
COT			B	F	L	S	
AO BO	42 17	Y-O O-Y	SLOT 2	SLOT 6	SLOT 10	SLOT 14	Unit 0
CO Spare	43 18	Y-G G-Y					
A1 B1	44 19	Y-BR BR-Y					Unit 1
C1 Spare	45 20	Y-S S-Y					
A2 B2	46 21	V-BL BL-V					Unit 2
C2 Spare	47 22	V-O O-V					
A3 B3	48 23	V-G G-V					Unit 3
C3 Spare	49 24	V-BR BR-V					
Spare Spare	50 25	V-S S-V					Spare

Table 21
NT5K60 and NT5K61 Analog CO Trunk connections for NT8D37 I/O panel connectors C, G, M, T (Part 1 of 2)

Lead Designations	Pin Numbers	Pair Colour	I/O Panel connector				Unit Number
COT			C	G	M	T	
A4 B4	26 1	W-BL BL-W	SLOT 2	SLOT 6	SLOT 10	SLOT 14	Unit 4
C4 Spare	27 2	W-O O-W					
A5 B5	28 3	W-G G-W					Unit 5
C5 Spare	29 4	W-BR BR-W					
A6 B6	30 5	W-S S-W					Unit 6
C6 Spare	31 6	R-BL BL-R					
A7 B7	32 7	R-O O-R					Unit 7
C7 Spare	33 8	R-G G-R					

Table 21
NT5K60 and NT5K61 Analog CO Trunk connections for NT8D37 I/O panel connectors C, G, M, T (Part 2 of 2)

Lead Designations	Pin Numbers	Pair Colour	I/O Panel connector				Unit Number
COT			C	G	M	T	
AO BO	34 9	R-BR BR-R	SLOT 3	SLOT 7	SLOT 11	SLOT 15	Unit 0
CO Spare	35 10	R-S S-R					
A1 B1	36 11	BK-BL BL-BK					Unit 1
C1 Spare	37 12	BK-O O-BK					
A2 B2	38 13	BK-G G-BK					Unit 2
C2 Spare	39 14	BK-BR BR-BK					
A3 B3	40 15	BK-S S-BK					Unit 3
C3 Spare	41 16	Y-BL BL-Y					
A4 B4	42 17	Y-O O-Y					Unit 4
C4 Spare	43 18	Y-G G-Y					
A5 B5	44 19	Y-BR BR-Y					Unit 5
C5 Spare	45 20	Y-S S-Y					
A6 B6	46 21	V-BL BL-V					Unit 6
C6 Spare	47 22	V-O O-V					
A7 B7	48 23	V-G G-V					Unit 7
C7 Spare	49 24	V-BR BR-V					
Spare Spare	50 25	V-S S-V					Spare

Table 22
NT5K60 and NT5K61 Analog CO Trunk connections for Option 11

The Analog trunk cards may be mounted in any slot which will support an IPE card.

Lead Designations COT	Pin Numbers	Pair Colour	Unit Number
AO BO	26 1	W-BL BL-W	Unit 0
CO Spare	27 2	W-O O-W	
A1 B1	28 3	W-G G-W	Unit 1
C1 Spare	29 4	W-BR BR-W	
A2 B2	30 5	W-S S-W	Unit 2
C2 Spare	31 6	R-BL BL-R	
A3 B3	32 7	R-O O-R	Unit 3
C3 Spare	33 8	R-G G-R	
A4 B4	34 9	R-BR BR-R	Unit 4
C4 Spare	35 10	R-S S-R	
A5 B5	36 11	BK-BL BL-BK	Unit 5
C5 Spare	37 12	BK-O O-BK	
A6 B6	38 13	BK-G G-BK	Unit 6
C6 Spare	39 14	BK-BR BR-BK	
A7 B7	40 15	BK-S S-BK	Unit 7
C7 Spare	41 16	Y-BL BL-Y	

Technical description

Power requirements

The X3W cards get all the necessary voltages from the shelf power supply. The power requirements are shown in the following table.

Table 23
Power requirements for NT5K60 and NT5K61

Voltage (VDC)	Max. Current all units idle	Max. Current all units active	Usage
+15 V*	90 mA	200 mA	Analog
-15 V*	105 mA	215 mA	Analog
+8.5 V**	100 mA	100 mA	B34
-48 V	50 mA	550 mA	Logic, A07
+5 V	200 mA	200 mA	Line signaling
-60 V	500 mA	800 mA	Line signaling

Note: * Analog circuitry is powered with ±12 V generated from ±15 V.

Note: ** 8.5 V is regulated to give 5 V for transmission circuits (e.g., CODEC).

The -60 V is from an on board, isolated power converter with a ±15 Vdc input and an isolated 12 Vdc output which is combined with the -48 V to give -60 V for the line signaling.

Environmental specifications

The circuit card will meet the applicable environmental specs. outlined in the Meridian 1 System General Specification.

Table 24
Temperature and Humidity requirements for the NT5K60 and NT5K61

Description	Specification	Requirement
High temp. operation	IEC 68-2-2 Bd	Will operate correctly for 2 hours at 40° C
Low temp. operation	IEC 68-2-1 Ad	Will operate correctly for 2 hours at 0° C
High humidity operation	IEC 68-2-3 Ca	Will operate correctly after 3 days at +40° C and 93% RH
Thermal cycling	IEC 68-2-14 Nb	Will operate correctly during the following cycle sequence. 3 cycles, Extremes: 0° C to +50° C Cycling: 1) 25=>50=> etc. Rate of temperature change; 1 deg./3 min. Cycle duration: 6 hrs.
High temp. storage	IEC 68-2-2 Bd	Will operate correctly after 16 hrs. storage at +70° C
Low temp. storage	IEC 68-2-1 Ab	Will operate correctly after 16 hrs. storage at -40° C
High humidity storage	IEC 68-2-3 Ca	Will operate correctly after 10 days storage at +40° C, and 93% RH

CIS Digital CO Trunk — NTCG01/02

The Commonwealth of Independent States (CIS) Digital Trunk Interface (DTI) allows the Meridian 1 to connect Direct Inward Dialing (DID)/Central Office Trunk (COT) trunks to a CIS Public Exchange/Central Office and to a CIS toll exchange.

To satisfy the unique requirements of CIS DTI signaling, two new trunk cards have been introduced: a dual 2 Mbps Enhanced Network (ENET) styled digital trunk card NTCG01AA (CDTI2); and a 2 Mbps digital trunk card NTCG02AA (CSDTI2) for use with Option 11 systems. The CDTI2 card provides 60 voice or data (64 kbps) channels, whereas the CSDTI2 card provides 30 voice or data (64 kbps) channels. Each card occupies one card slot on the common equipment shelf (CDTI2), or on the Option 11 base cabinet (CSDTI2).

In addition to most of the features provided by digital trunks, the CDTI2 and CSDTI2 cards provide the following features intended for the CIS market:

— CIS digital trunk signaling (incoming toll, outgoing and incoming local calls)

— Automatic Number Identification (ANI) transmission for outgoing calls on request from the Public Exchange

— Special disconnect procedure (two-way release) on incoming local answered calls initiated by the Public Exchange to provide Malicious Call Trace

— Unanswered free special service calls; outgoing calls that remain unanswered are recognized in a special manner to allow the called party (special service operator) to disconnect the calls

— CIS transmission plan

— Downloading the required firmware mode per loop, and

— Dial tone provided internally to the calling party by the Meridian 1 after seizure of an outgoing CIS trunk. However, for outgoing call terminating to a busy, vacant, invalid, or restricted DN, the Meridian 1 does not provide busy/overflow tone. The Public Exchange will send the tone on the speechpath.

The CIS DTI trunk provides significant improvement on real-time impact for dial pulse outpulsing and digit collection by transferring these processes from the software to the firmware. The trunk state change validation timing is performed by the firmware. A Firmware Unproductive Timer is used to prevent a call on a CIS trunk from remaining unanswered for too long.

Operating parameters

CDTI2 and CSDTI2 cards do not support Periodic Pulse Metering, continuous pulse detection, or echo suppression.

The only line signaling supported for CIS is a two-bit ABCD protocol. Register signalling supported for CIS is only Dial Pulse.

The data in ANI always refers to the originator of the outgoing call. If the call is transferred, the ANI information is not changed and therefore may be different than that of the set currently involved in the call.

On outgoing toll calls there is no delay. On outgoing local calls there is a 700 millisecond delay in the Answer signal recognition before the call is established.

Incoming and outgoing trunks cannot be mixed within the same route.

Toll Operator Break-In/Trunk Offer is not supported.

Toll Operator Manual Ringing is not supported.

MF Shuttle Register Signaling is not supported.

CSDTI2 cards are required for the Option 11, while CDTI2 cards are required for all other machine types.

Only ANI transmission is supported.

Feature interactions

Authorization Code

An extension may refer to an Authorization Code to seize an outgoing CIS DTI trunk. The Authorization Code category is used to build the Automatic Number Identification (ANI) message. Thus, a set having a CIS restricting call category can complete a call to the Public Network using the Authorization Code.

Called Party Disconnect Control (CPDC)

This feature may not be used in the CIS market because of its signaling requirements.

Computer to PBX Interface (CPI)

CPI is not supported on CDTI2/CSDTI2 because the protocol conversion is not supported.

Call Detail Recording (CDR)

If ANI is requested to be output in the CDR record, it will not refer to the CIS DTI2 ANI.

Data Transmission

All features connected with Data Transmission must be used with caution, because the ANI interaction can happen at any time during an outgoing call, thus destroying the transmitted data and disrupting the call.

Dial Tone Detection

Dial tone detection is supported, but with the limitation of low reliability of the tone provided by the Public Exchange.

Incoming Digit Conversion

The construction of an ANI message does not care if Incoming Digit Conversion is used. The DN sent as ANI is the actual DN of the set, not necessarily the Direct Inward Dialing (DID) number to dial to reach the set. Therefore, if an external party uses a DN, delivered in an ANI message, for making a call to the corresponding extension, the call may fail.

Japan DTI2

All features related to Japan DTI2 may not be used, because the proper Scan and Signaling Distributor (SSD) messages are not supported in the CDTI2/CSDTI2 firmware.

Multiple Appearance DNs

Since the ANI category is defined on a per set basis, two stations with the same Multiple Appearance Directory Number (MADN) can be assigned different ANI categories.

Periodic Pulse Metering

Periodic Pulse Metering is not supported.

Pulsed E&M

Pulsed E&M is not supported.

R2MFC Calling Number Identification (CNI)

The incoming R2MFC will be tandemed if the call is outgoing to a CIS trunk, however, the CNI information will not be transported across the gateway. The ANI built will be the LEC of the outgoing CIS route, the ANI DN of this R2MFC incoming route if defined (otherwise it will be the ANI DN of the outgoing CIS route, or the ADDG digit), and the CAC of this incoming R2MFC route.

The category (CAC) used to build the R2MFC Calling Number Identification for the analog, digital, and Basic Rate Interface (BRI) sets is also used to build the CIS Automatic Number Identification (ANI). The meaning of CAC is different between the R2MFC CNI signalization and the CIS signalization (analog BRI and digital). R2MFC CAC prompt values are in the range of 0–10, with the default value of 0. CIS CAC prompt values are in the range of 0–9, with the default value of 3.

If the MFC package is equipped, but not the CIST package, the CAC prompt uses the R2MFC range and default. If the CIST package is equipped, whether or not the MFC package is equipped, the CAC prompt uses the CIS range and default.

Note: If the system is equipped with both CIS and R2MFC trunks, a Common Category (CAC) is used for both signal types. The Category prompt is set to the default value for the CIS trunk, not to that of the R2MFC trunk.

Tandem Switching

If the ISDN TIE incoming trunk (DPNSS1, MCDN or QSIG) with Calling Line Identification (CLID) or Originating Line Identification (OLI) available seizes the CIS DTI2 outgoing trunk with non-zero RDNL defined in LD 16, then the ANI DN to be used for sending to the CIS Public Exchange is extracted from this CLID/OLI. RDNL defines in such a case the number of digits extracted from the CLID/OLI. The least significant digits will be extracted.

If the CLID/OLI is available, but RDNL=0, or CLID/OLI is *not* available or the incoming trunk is not one of the above listed types, the ANI DN is taken from the ANDN of the incoming route definition.

If the ANDN is not defined for the incoming route, then ANDN of the CIS DTI2 outgoing route will be used to build the ANI.

If, at last, the ANDN for the CIS DTI2 outgoing route is also not defined, then the ANI DN will be built with the Additional Digit (ADDG) defined for this route.

Virtual Network Services (VNS)

Virtual Network Services via CIS DTI2 is not supported.

Software packaging

This software is packaged as Commonwealth of Independent States Trunk Interface (CIST) package 221.

The following packages are required:

— Flexible Tones and Cadences (FTC) package 125

— 2 Mbps Digital Trunk Interface (DTI2) package 129

— International Supplementary Features (SUPP) package 131

— Flexible Numbering Plan (FNP) package 160

Feature implementation

Table 25
LD 17 – Change system configuration data.

Prompt	Response	Description
REQ	CHG	Change.
...		
PARM	YES	
...		
PCML	(MU), A	System Companding Law. The A-law should be chosen for the CIS market.
SEQU	YES	
...		
DTI2	<loop> <loop>...	Define CDTI2/CSDTI2 loops exactly like existing DTI2/SDC2.

Table 26
LD 73 – Define DTI2 data.

Prompt	Response	Description
REQ	CHG	Change.
TYPE	DTI2	DTI2 Data Block.
FEAT	LPTI	Loop timers and some other per DTI2 loop defined parameters.
LOOP	<loop>	DTI2 loop number.
CDTI2	YES	CDTI2/CSDTI2 card.
P DIGIT (S)	PXXX	DP outpulsing will be sent on signaling bit A.
P METR (R)	NO	Pulse Metering.

Prompt	Response	Description
SASU	1024	Seize Acknowledgment Supervision timer is defined in milliseconds (rounded to the closest multiple of 128 milliseconds).
...		
MFF	CRC (AFF)	CRC4 or Alternate Frame Format may be chosen.
...		
CISFW	YES	Prompted only if Commonwealth of Independent States – Digital Trunk Interface (CIST) package 221 is equipped and CDTI2 = YES.

Table 27
LD 73 – Define the SICA table for CDTI2/CSDTI2.

Prompt	Responses			Description
	Incoming local trunk	Incoming toll trunk	Outgoing trunk	
REQ	CHG	CHG	CHG	Change.
TYPE	DTI2	DTI2	DTI2	DTI2 Data Block.
FEAT	ABCD	ABCD	ABCD	Signaling category.
SICA	2–16	2–16	2–16	SICA table number.
...				
Incoming/ Outgoing Calls				
IDLE(S)	0101	0101	1101	Idle sent
IDLE(R)	1101	1101	0101	Idle received
FALT(S)	1101	1101	1101	Fault sent (referred to as blocked in CCITT terminology).
FALT(R)	1101	1101	1101	Fault received (referred to as blocked in CCITT terminology).
Incoming Calls				
E_SEZ(R)	1001	1001	1001	Seize.
SEZD(R)	N	0001	N	Seize for data calls.
P CALL (R)	N	N	N	Signal sent during seize by an incoming CO trunk.
SEZA (S)	1101	1101	1101	Seize Acknowledge.
P DIGT(R)	Pxxx	Pxxx	Pxxx	DP Digits received decadic pulses.
NRCV(S)	N	N	N	Number received.
P EOSF(S)	N	N	N	Pulsed End of Selection Free is not used.

Prompt	Responses			Description
	Incoming local trunk	Incoming toll trunk	Outgoing trunk	
EOSF(S)	N	1001	N	Steady End of Selection Free.
P EOSB(S)	N	N	N	Pulsed End of Selection Busy is not used.
EOSB (S)	0001	0001	N	Steady End of Selection Busy.
P OPCA(R)	N	N	N	Operator calling.
E_CONN(S)	1001	1101	1001	Connect Send (Answer).
CONN(R)	1001	1001	1001	Connect received.
P RRC(S)	N	N	N	Register recall.
P BURS(S)	N	N	N	Bring up receiver for L1 networking.
P BURS(R)	N	N	N	Bring up receiver for L1 networking.
C_CLRB(S)	0001	1001	0001	Clear Back (B Ring Off).
CLRF(R)	0001	N	N	Clear Forward (A Ring Off) – used only to start two-way release.
P OPRS(R)	N	N	N	Operator manual recall.
P NXFR(S)	N	N	N	Network transfer.
P ESNW(S)	N	N	N	ESN wink.
P CAS(S)	N	N	N	Centralized attendant.
Outgoing Calls				
E_SEZ(S)	1001	1001	1001	Seize.
SEZD(S)	N	N		Seize for data calls.
SEZA(R)	1101	1101	1101	Seize Acknowledge.
P WNKS(R)	N	N	N	Wink start.

Prompt	Responses			Description
	Incoming local trunk	Incoming toll trunk	Outgoing trunk	
P EOS(R)	N	N	N	End of selection busy.
CONN(S)	N	N	N	Connect.
E_CONN(R)	1001	1001	1001	Connect Receive (Answer).
P OPRC(R)	N	N	N	Operator recall for special services.
P BURS(S)	N	N	N	Bring up receiver for L1 networking.
P BURS(R)	N	N	N	Bring up receiver for L1 networking.
C_CLRB(R)	0001	0001	0001	Clear Back (B Ring Off).
CLRF(S)	N	N	N	Clear Forward (the same as the IDLE(S) signal).
P NXFR(R)	N	N	N	Network transfer.
P ESNW(R)	N	N	N	ESN wink.
P CAS(R)	N	N	N	Centralized Attendant Service.

Table 28
LD 97 – Define dial pulse make-break ratio.

Prompt	Response	Description
REQ	CHG	Change.
TYPE	SYSP	System parameters.

Prompt	Response	Description
INTN	YES	A-law should be used as system companding law.
...		
P10R	(50)–70	Make-break ratio for primary 10 pulses per second dial pulse dialing.
P12R	(50)–70	Make-break ratio for secondary 10 pulses per second dial pulse dialing.
P20R	(50)–70	Make-break ratio for 20 pulses per second dialing.

Table 29
LD 15 – Define Customer Data Block.

Prompt	Response	Description
REQ	NEW, CHG	New or change.
TYPE	CDB	Customer Data Block.
CDB	0–99	Customer number.
...		
BOTO	30	Busy tone/overflow tone time out (in seconds).

Table 30
LD 16 – Add or change route data for CIS DTI2 trunks.

Prompt	Response	Description
REQ	NEW, CHG	New or change.
TYPE	RDB	Route Data Block.
...		
TKTP	DID, COT	Trunk type, where: DID = incoming trunks route, and COT = outgoing trunks route.
...		

Prompt	Response	Description
DTRK	YES	Digital trunk.
DGTP	DTI2	Digital trunk type for route.
...		
ASUP	YES	Return answer supervision to originator.
...		
ICOG	ICT OGT	Incoming trunk. Outgoing trunk.
...		
CNTL	YES	Changes to controls or timers.
TIMR	DDL 0	Delay Dial Timer not needed.
TIMR	DSI 5000	Disconnect supervision timer (five-second value).
TIMR	EOD 13952	End of dial timer (default value).
TIMR	SFB 25	Seize Fail Busy timer. The recommended value for trunks with seizure supervision is 25 seconds.
TIMR	ATO 30000	ANI delay timer should be defined for CIS outgoing trunk routes with 30000–50000 ms (30–50 sec.) value. In cases where the Local Exchange to which the outgoing trunk is connected doesn't perform the ANI interaction immediately after dialing the Toll access code, the ATO should be defined with minimum value, 128 ms.
TIMR	GTI 128	Incoming Guard timer, 128 ms.
...		
NEDC	ORG, ETH	Near end disconnect control, where: ORG = originating end disconnect control for incoming calls, and ETH = either end control for outgoing calls.
FEDC	ORG, ETH	Far end disconnect control, where: ORG = originating end disconnect control for incoming calls, and ETH = either end control for outgoing calls.

Prompt	Response	Description
CDPC	NO	Meridian 1 is not the only controlling party on incoming calls.
...		
OPCB	NO	External operator features not allowed on this route.
...		
CGPC	NO	Calling party control of calls not enabled.
CDCT	NO	Called party control of call is not enabled.
DDO	NO	Do not delay digit outpulsing for DOD trunks.
...		
DTD	NO	Dial tone detection is not to be performed on this route.
...		
NATL	NO	North American toll scheme is not used.
TDG	8	Toll digit (list of digits after the trunk access code which indicate toll calls). This can also be defined in SSL in LD 18.
SSL	1–15	Special Service List number (must be previously defined in LD 18).
...		
PRDL	YES	Partial dial timing is equipped using EOD.
DNSZ	(0)–7	Number of digits expected on DID routes. 0 (the default) indicates no fixed value. This value must be defined according to the numbering plan.
...		
BTT	30	Duration of busy/overflow tone to be returned on DID route in seconds.

Prompt	Response	Description
...		
LEC	0–9999999	Local Exchange Code.
ADDG	0–9	Additional digit.
CAC	0–(3)–9	Route ANI category.
ANDN	0–9999999	Route ANI DN.

Table 31
LD 16 – Add or change route data for an incoming, non CIS DTI2, trunk.

Prompt	Response	Description
REQ	NEW, CHG	New or change.
TYPE	RDB	Route Data Block.
...		
ICOG	ICT IAO	Incoming trunk. Incoming and outgoing trunk.
...		
CAC	0–(3)–9	Route ANI category.
ANDN	0–9999999	Route ANI DN.
RDNL	0–(4)–7	Remote DN Length.

Note: Trunks within this route may be any kind of trunk. If this trunk, used as an incoming trunk, originates an outgoing call to a CIS DTI2 trunk, its CAC and ANDN are used in the ANI information sent out.

Table 32
LD 14 – Add or change trunk data for CIS DTI2 incoming and outgoing trunk.

Prompt	Response	Description
REQ	NEW, CHG	New or change.
TYPE	DID/COT	Direct Inward Dialing (for incoming trunks), or Central Office Trunk (for outgoing trunks).
...		
SICA	2–16	Signaling category table number. ***Note:*** standard default SICA table (number 1) may not be used for CIS DTI2 trunks. CIS DTI2 trunks for incoming local, outgoing local and incoming toll calls must have different SICA tables.
PDCA	(1)–16	PAD table number.
PCML	A	Only A-law companding may be used on the CIS DTI2 trunk line.
...		
CLS	(DIPF), DIP	Dial pulse execution, where: DIP = outpulsing by firmware, digit collection — traditional, by software, and DIPF = outpulsing and digit collection are performed by firmware.
	(P10), P12	Make-break ratio for dial pulse dialing.

Table 33
LD 10 – Add or change PBX telephones.

Prompt	Response	Description
REQ	NEW, CHG	Add or change.
TYPE	500	500/2500 telephone data block.
...		
CAC	0–(3)–9	Specify ANI category for CIS DTI2 calls.
CLS	(DNAA), DNAD	DN of set (allowed) not allowed for use in ANI messages.

Table 34
LD 11 – Add or change BCS telephones.

Prompt	Response	Description
REQ	NEW, CHG	Add or change.
TYPE	aaaa	Telephone data block, where: aaaa = SL1, 2006, 2008, 2009, 2016, 2018, 2112, 2216, 2317, 2616, or 3000.
...		
CAC	0–(3)–9	Specify ANI category for CIS DTI2 calls.
CLS	(DNAA), DNAD	DN of set (allowed) not allowed for use in ANI messages.

Table 35
LD 12 – Add or change Attendant Consoles.

Prompt	Response	Description
REQ	NEW, CHG	Add or change.
TYPE	ATT, 1250, 2250	Type of Attendant Console.
...		
DNAN	(DNAA), DNAD	For CIS ANI purposes, the ANI DN will be LDN0 (defined in LD 15).

Table 36
LD 27 – Add or change Digital Subscriber Loop (BRI set) for CIS.

Prompt	Response	Description
REQ	NEW, CHG	Add or change.
TYPE	DSL	Digital Subscriber Loop.
...		
CAC	0–(3)–9	Specify ANI category for CIS DTI2 calls.
CLS	(DNAA), DNAD	DN of set (allowed) not allowed for use in ANI messages.

Table 37
LD 88 – Add or change the Authcode data block.

Prompt	Response	Description
REQ	NEW, CHG	New or change.
TYPE	AUB	Authcode data block.
...		
CLAS	(0)–115	Classcode value assigned to Authcode (NAUT).
...		
NCOS	(0)–99	Network Class of Service group number.
CAC	0–(3)–9	ANI category for CIS DTI2 calls.

Table 38
LD 56 – Configure the dial tone.

Prompt	Response	Description
REQ	NEW, CHG	New or change.
TYPE	DTAD	Special dial tone after dialed number.
DDGT	0–9999	Used as the outgoing local access code. "9" is defined mostly
TONE	SRC1	Dial tone to be provided after the dialed DDGT code (Source Tone 1).
...		
REQ	NEW, CHG	New or change.
TYPE	FTC	Flexible Tones and Cadences data block.
TABL	0–31	FTC table number.
DFLT	0–31	Default FTC table.
...		
SRC	YES	Change Source Tones (SRC1-SCR8).
SRC1		Source Tone 1.
TDSH	0 0 0 3	Tone number 3 on QPC609 provides 400 Hz, -23 db.
XTON	159	NT8D17 TDS tone code: 420 Hz, -25 db, A-law.
XCAD	0	NT8D17 cadence code for FCAD (steady tone).

Table 39
LD 56 – Configure Tone to Last Party.

Prompt	Response	Description
REQ	NEW, CHG	New or change.
TYPE	FTC	Flexible Tones and Cadences data block.
TABL	0–31	FTC table number.
DFLT	0–31	Default FTC table.
RING	<CR>	
HCCT	YES	Change the TDS card controlled cadence tones.
...		
TLP		Tone to Last Party.
TDSH	0 0 31 3	Cadence 31 in MCAD table will provide repeating 256 ms burst and 256 ms silence. Tone number 3 on QPC609 provides 440 Hz, -23 db.
XTON	159	NT8D17 TDS tone code: 420 Hz, -25 db, A-law.
XCAD	31	NT8D17 cadence code for FCAD.
TLTP	30	Tone to Last Party timer in seconds.
...		
REQ	NEW, CHG	New or change.
TYPE	MCAD	Master Cadence table.
WCAD	31	Cadence number. In this example entry 31 is modified.
CDNC	0051 0051	Repeating 256 ms burst and 256 ms silence.

Prompt	Response	Description
...		
REQ	NEW, CHG	New or change.
TYPE	FCAD	Firmware Cadence table.
WCAD	31	Cadence number. In this example entry 31 is modified.
CDNC	0060 0060	Repeating 300 ms burst and 300 ms silence.

Table 40
LD 18 – Configure the Special Service list.

Prompt	Response	Description
REQ	NEW, CHG	Add, or change.
TYPE	SSL	Special Service List.
CUST	0–99	Customer Number
SSL	1–15	SSL number.
SSDG	Xxxx	Special Service Digits combination. (1–4 digits)
...		
TOLL	(NO), YES	Toll access code mark.
...		
SSUC	(NO), YES	Special Service Unanswered Call mark. If the outgoing call is recognized as SSUC (first 1–4 digits outpulsed to the trunk are equal to the SSDG with SSUC = YES), then such a call requires some specific disconnect treatment.

Connection Tables

Three types of cables will be used by the CDTI large systems and two additional ones will be used by the CSDTI small systems.

Large systems connection tables (NTCG01AA Card)

Three cables are used with the NTCG01AA card:

— A standard telephone cable to connect the recovered clocks to the clock controller (NTCG03AA). A special RJ11 to D-Type 9 adaptor will be used.

— A cable to connect the trunks to the I/O panel on the backplane of the Meridian 1 switch (NTCK45AA for 120 ohm or NTCK79AA for 75 ohm).

— A cable to connect the MON port to an external Monitor.

The following table shows connections from the faceplate of the NTCG01AA card through the custom RJ11 to D-Type 9 pin adaptor then to the M1 clock controller card.

Name	Description	CDTI2 RJ11 pin number	Telephone cable conductor color	D-Type 9 pin Adaptor	Electrical standard
-CLK	negative reference clock	3	Yellow	2	RS-422
+CLK	positive reference clock	4	Green	6	RS-422
GND	Ground	5	Red	1	Logic Ground

There are following four (4) clock reference connectors on the NTCG01 faceplate:

— J1 — recovered clock 1 from trunk 0

— J2 — recovered clock 2 from trunk 0

— J3 — recovered clock 1 from trunk 1

— J4 — recovered clock 2 from trunk 1

Table 41 shows the connections for the 120 ohm cable from the faceplate of the NTCG01AA card to the I/O panel. The cable has one Male D-Type 9 pin connector on the card side and splits into two Male D-Type 9 pin connectors on the I/O side.

Table 41
NTCG01AA connections (120 cable)

Cable	Name	Description	Color	CDTI2 side pins	I/O Panel side pins	Electrical Standard
0	T-PRI0TX	Trunk 0 Transmit Tip	Black	P1-1	P2-6	Balance
0	R-PRI0TX	Trunk 0 Transmit Ring	Red	P1-2	P2-7	Balance
0	T-PRI0RX	Trunk 0 Receive Tip	Black	P1-3	P2-2	Balance
0	R-PRI0RX	Trunk 0 Receive Ring	White	P1-4	P2-3	Balance
0		GND Shield Wire	Bare	N/C	Case P2	
0		GND Shield Wire	Bare	N/C	Case P2	
0		Standard wire (3″)	Bare	Case P2	P2-5	
0		Standard wire (3″)	Bare	Case P2	P2-9	
1	T-PRI1TX	Trunk 1Transmit Tip	Black	P1-5	P3-6	Balance
1	R-PRI1TX	Trunk 1Transmit Ring	Red	P1-6	P3-7	Balance
1	T-PRI1RX	Trunk 1Receive Tip	Black	P1-7	P3-2	Balance
1	R-PRI1RX	Trunk 1Receive Ring	White	P1-8	P3-3	Balance
1		GND Shield Wire	Bare	N/C	Case P3	
1		GND Shield Wire	Bare	N/C	Case P3	
1		Standard wire (3″)	Bare	Case P3	P3-5	
1		Standard wire (3″)	Bare	Case P3	P3-9	

Table 42 shows the connections for the 75 ohm cable from the faceplate of the NTCG01AA card to external equipment. The cable has one Male D-Type 9 pin connector on the card side and splits into two cables each of which have two BNC connectors on the external equipment side. The length of the cable is 40 feet

Table 42
NTCG01AA connections (75 ohm)

Cable	Name	Description	Color	CDTI2 side pins	I/O Panel side pins	Electrical Standard
0	T-PRI0TX	Trunk 0 Transmit Tip	Red	P1-1	P2 inner conductor	Unbalance
0	R-PRI0TX	Trunk 0 Transmit Ring	Red	P1-2	P2 shield	Unbalance
0	T-PRI0RX	Trunk 0 Receive Tip	Green	P1-3	P3 inner conductor	Unbalance
0	R-PRI0RX	Trunk 0 Receive Ring	Green	P1-4	P3 shield	Unbalance
1	T-PRI1TX	Trunk 1 Transmit Tip	Red	P1-5	P4 inner conductor	Unbalance
1	R-PRI1TX	Trunk 1 Transmit Ring	Red	P1-6	P4 shield	Unbalance
1	T-PRI1RX	Trunk 1 Receive Tip	Green	P1-7	P5 inner conductor	Unbalance
1	R-PRI1RX	Trunk 1 Receive Ring	Green	P1-8	P5 shield	Unbalance
		Outer Metalised PVC Material	Bare	N/C	P1 Case	
		3 standard wire	Bare	N/C	P1 Case	

Small systems connection tables (NTCG02AA Card)

Two cables are used with the NTCG02AA card:

— 120 ohm trunk cable (NTBK05AA)

— 75 ohm trunk cable (NTBK05CA)

The following table shows the single trunk connections for the 120 ohm cable from the corresponding slot from the bottom of the Option 11 cabinet to the cross-connect terminal. The cable has one D-Type 50 pin connector on the card side and a D-Type 9 pin connector on the cross-connect side. The length of the cable is 20 feet.

From: 50 pin MDF connector	To: 9 pin connector	Color	Signal
23	6	Black	R0
48	7	White	T0
50	9	Bare	R0/T0 FGND
24	2	Black	R1
49	3	Red	T1
25	5	Bare	R1/T1 FGND

The following table shows the single trunk connections for the 75ohm cable from the corresponding slot from the bottom of the Option 11 cabinet to the cross-connect terminal. The cable has one D-Type 50 pin connector on the card side and a double BNC connector on the cross-connect side. The length of the cable is 20 feet.

From: 50 pin MDF connector	To: Transmit coax connector	To: Receive coax connector	To: 50 pin MDF connector
23	inner conductor	-	-
48	outer conductor	-	-
24	-	inner conductor	-
49	-	outer conductor	-
21	-	-	49
46	-	-	48

Technical description

Power requirements

The following table lists the power requirements for the NTCG01/02 trunk cards.

NTCG01

Voltage	Current
+ 5V	3 A
+ 12V	100 mA
- 12V	100 mA
Total Power	**17.5 W**

NTCG02

Voltage	Current
+ 5V	2.5 A
+ 15V	50 mA
- 15V	50 mA
Total Power	**14 W**

Environmental specifications

The following table provides the temperature specifications for the NTCG01/02 trunk card.

Conditions	Minimum	Maximum
Normal operating	0° C	+ 45° C
Short term operating	0° C	+ 50° C
Storage	- 50° C	+70° C

The following table provides the humidity specifications for the NTCG01/02 trunk card.

Conditions	Minimum	Maximum	Comments
Operating	5%	95%	non-condensing from 0 to 50° C
Non-operating	5%	95%	non-condensing from 0 to 70° C

DIP Switches

General purpose switches (S11) on NTCG01

Switch #	State	Description
1	ON	-7.3 dBm ANI level for trunk 0
	OFF	-3 dBm ANI level for trunk 0
2	ON	-7.3 dBm ANI level for trunk 1
	OFF	-3 dBm ANI level for trunk 1
3	ON	120 Ω interface for trunk 0
	OFF	75 Ω interface for trunk 0
4	ON	120 Ω interface for trunk 1
	OFF	75 Ω interface for trunk 1

These switches are used to set operation parameters for the firmware.

Trunk interface switches (S6) on NTCG01

Switch #	State	Description
1	OFF	Must be off
2	OFF	Must be off
3	ON	75 Ω interface for trunk 0
	OFF	120 Ω interface for trunk 0
4	OFF	Must be off

Switch #	State	Description
5	OFF	Must be off
6	ON	75 Ω interface for trunk 1
	OFF	120 Ω interface for trunk 1
7	OFF	Must be off
8	OFF	Must be off

These switches select the analog interface of the trunks.

Ring grounding switches (S10) on NTCG01

Switch #	State	Description
1	ON	Ground Trunk 0 Tx Ring
	OFF	Do Not Ground Trunk 0 Tx Ring
2	ON	Ground Trunk 0 Rx Ring
	OFF	Do Not Ground Trunk 0 Rx Ring
3	ON	Ground Trunk 1 Tx Ring
	OFF	Do Not Ground Trunk 1 Tx Ring
4	ON	Ground Trunk 1 Rx Ring
	OFF	Do Not Ground Trunk 1 Rx Ring

These four switches set Ring line grounding for 75 ohm operation: switches 2 and 4 must be ON and switches 1 and 3 must be OFF. If 120 ohm trunk interface is used then all the switches 1, 2, 3, 4 must be OFF.

S1 DIP switches on NTCG02

Switch #	OFF ("1") (Switch open)	ON ("0") (Switch closed)
S1–1	Must be OFF	
S1–2	120 Ω	75 Ω
S1–3	ANI Level -3 dBm	ANI Level -7.3 dBm
S1–4	Must be OFF	
S1–5	Must be OFF	
S1–6	AIS T.S. 16 is not configured	AIS T.S. 16
S1–7	Must be OFF	
S1–8	Must be OFF	

S2 DIP switches on NTCG02

Switch #	OFF ("1") (Switch open)	ON ("0") (Switch closed)
S2–1	Normal connection for 120 Ω connection	Tx ring is shorted to ground for 75 Ω connection
S2–2	Normal connection for 120 Ω connection	Rx ring is shorted to ground for 75 Ω connection
S2–3	For 120 Ω connection	For 75 Ω connection
S2–4	For 120 Ω connection	For 75 Ω connection
S2–5	No connection between the coax cable shield and frame ground	Connection between the coax cable shield and frame ground
S2–6	No connection between the coax cable shield and frame ground	Connection between the coax cable shield and frame ground
S2–7	Must be OFF	
S2–8	Must be OFF	

S2–5 and S2–6 switches allowing selective shield of the Tx and/or Rx pairs of the carrier. Closing the switch (down position) applies Frame Ground (FGND) to the coaxial carrier cable shield, creating a 75 ohm unbalanced configuration.

S3, S4, S5, S6 DIP switches on NTCG02

All of these switches must be in the "1" (DOWN) position.

E&M TIE trunk circuit card — NT5K83

Functional description

The NT5K83 E&M TIE trunk card provides the interface between the Meridian 1 system and up to four analog trunks. It can be installed in any PE slot that supports Intelligent Peripheral Equipment (IPE).

The NT5K83 E&M TIE trunk card supports four analog trunks. Each trunk circuit can be individually configured as:

— 4-wire E&M Type 5 and 2

— Recorded Announcement trunk (RAN)

— Music trunk (MUS)

— Paging trunk (PAG)

Common features

The NT5K83 E&M TIE trunk card:

— is equipped with four trunk units

— converts transmission signals from analog-to-digital and from digital-to-analog

— enables and disables individual units or the entire card under software control

— provides outpulsing on the card. Make break ratios are defined in software and down loaded during power up and by software commands.

— provides indication of card status from self-test diagnostics on the LED

— allows trunk type to be configured on a per unit basis in software

— provides termination against 600 ohms for 4-wire E&M trunk circuits

— provides paging (PAG), recorded announcement (RAN), and Music interfaces.

Physical description

Switch settings

There are no option switches on the NT5K83 E&M TIE trunk card. All settings are configured in software.

Connections

The NT5K83 E&M TIE trunk card has four units. Each unit connects to the shelf backplane through an 80-pin connector. The backplane is cabled to the input/output (I/O) panel which is then cabled to the cross-connect terminal.

Tables 43 to 53 show cross connect terminations for the NT5K83 E&M trunk card.

Table 43
NT5K83 E&M 2-Wire Paging trunk connections for NT8D37 I/O panel connectors A, E, K, R

Pair	Pins	Pair Color	I/O Panel Connector				Unit Number
			A	E	K	R	
T0 R0	27 2	W-O O-W	SLOT 0	SLOT 4	SLOT 8	SLOT 12	Unit 0
A PG	29 4	W-BR BR-W					
T1 R1	31 6	R-BL BL-R					Unit 1
A PG	33 8	R-G G-R					
T2 R2	35 10	R-S S-R					Unit 2
A PG	37 12	BK-O O-BK					
T3 R3	39 14	BK-BR BR-BK					Unit 3
A PG	41 16	Y-BL BL-Y					

Table 44
NT5K83 E&M 2-Wire Paging trunk connections for NT8D37 I/O panel connectors B, F, L, S

Pair	Pins	Pair Color	I/O Panel Connector				Unit Number
			B	F	L	S	
T0 R0	27 2	W-O O-W	SLOT 1	SLOT 5	SLOT 9	SLOT 13	Unit 0
A PG	29 4	W-BR BR-W					
T1 R1	31 6	R-BL BL-R					Unit 1
A PG	33 8	R-G G-R					
T2 R2	35 10	R-S S-R					Unit 2
A PG	37 12	BK-O O-BK					
T3 R3	39 14	BK-BR BR-BK					Unit 3
A PG	41 16	Y-BL BL-Y					
T0 R0	43 18	Y-G G-Y	SLOT 2	SLOT 6	SLOT 10	SLOT 14	Unit 0
A PG	45 20	Y-S S-Y					
T1 R1	47 22	V-O O-V					Unit 1
A PG	49 24	V-BR BR-V					

Table 45
NT5K83 E&M 2-Wire Paging trunk connections for NT8D37 I/O panel connectors C, G, M, T

Pair	Pins	Pair Color	I/O Panel Connector				Unit Number
			C	G	M	T	
T2 R2 A PG	27 2 29 4	W-O O-W W-BR BR-W	SLOT 2	SLOT 6	SLOT 10	SLOT 14	Unit 2
T3 R3 A PG	31 6 33 8	R-BL BL-R R-G G-R					Unit 3
T0 R0 A PG	35 10 37 12	R-S S-R BK-O O-BK	SLOT 3	SLOT 7	SLOT 11	SLOT 15	Unit 0
T1 R1 A PG	39 14 41 16	BK-BR BR-BK Y-BL BL-Y					Unit 1
T2 R2 A PG	43 18 45 20	Y-G G-Y Y-S S-Y					Unit 2
T3 R3 A PG	47 22 49 24	V-O O-V V-BR BR-V					Unit 3

Table 46
NT5K83 E&M 2-Wire Recorded Announcement trunk connections for NT8D37 I/O panel connectors A, E, K, R

Pair	Pins	Pair Color	I/O Panel Connector				Unit Number
			A	E	K	R	
T0 R0	26 1	W-BL BL-W	SLOT 0	SLOT 4	SLOT 8	SLOT 12	Unit 0
SIG B SIG A	29 4	W-BR BR-W					
T1 R1	30 5	W-S S-W					Unit 1
SIG B SIG A	33 8	R-G G-R					
T2 R2	34 9	R-BR BR-R					Unit 2
SIG B SIG A	37 12	BK-O O-BK					
T3 R3	38 13	BK-G G-BK					Unit 3
SIG B SIG A	41 16	Y-BL BL-Y					

Table 47
NT5K83 E&M 2-Wire Recorded Announcement trunk connections for NT8D37 I/O panel connectors B, F, L, S

Pair	Pin Numbers	Pair Color	I/O Panel Connector				Unit Number
			B	F	L	S	
T0 R0	26 1	W-BL BL-W	SLOT 1	SLOT 5	SLOT 9	SLOT 13	Unit 0
SIG B SIG A	29 4	W-BR BR-W					
T1 R1	30 5	W-S S-W					Unit 1
SIG B SIG A	33 8	R-G G-R					
T2 R2	34 9	R-BR BR-R					Unit 2
SIG B SIG A	37 12	BK-O O-BK					
T3 R3	38 13	BK-G G-BK					Unit 3
SIG B SIG A	41 16	Y-BL BL-Y					
T0 R0	42 17	Y-O O-Y	SLOT 2	SLOT 6	SLOT 10	SLOT 14	Unit 0
SIG B SIG A	45 20	Y-S S-Y					
T1 R1	46 21	V-BL BL-V					Unit 1
SIG B SIG A	49 24	V-BR BR-V					

Table 48
NT5K83 E&M 2-Wire Recorded Announcement trunk connections for NT8D37 I/O panel connectors C, G, M, T

Pair	Pin Numbers	Pair Color	I/O Panel Connector				Unit Number
			C	G	M	T	
T2 R2	26 1	W-BL BL-W	SLOT 2	SLOT 6	SLOT 10	SLOT 14	Unit 2
SIG B SIG A	29 4	W-BR BR-W					
T3 R3	30 5	W-S S-W					Unit 3
SIG B SIG A	33 8	R-G G-R					
T0 R0	34 9	R-BR BR-R	SLOT 3	SLOT 7	SLOT 11	SLOT 15	Unit 0
SIG B SIG A	37 12	BK-O O-BK					
T1 R1	38 13	BK-G G-BK					Unit 1
SIG B SIG A	41 16	Y-BL BL-Y					
T2 R2	42 17	Y-O O-Y					Unit 2
SIG B SIG A	45 20	Y-S S-Y					
T3 R3	46 21	V-BL BL-V					Unit 3
SIG B SIG A	49 24	V-BR BR-V					

Table 49
NT5K83 E&M 4-Wire Type 5 connections for NT8D37 I/O panel connectors A, E, K, R

Lead Designations	Pin Numbers	Pair Colour	I/O Panel connector				Unit Number
Type 1 mode			A	E	K	R	
TA TB	26 1	W-BL BL-W	SLOT 0	SLOT 4	SLOT 8	SLOT 12	
RA RB	27 2	W-O O-W					Unit 0
E M	28 3	W-G G-W					
TA TB	30 5	W-S S-W					
RA RB	31 6	R-BL BL-R					Unit 1
E M	32 7	R-O O-R					
TA TB	34 9	R-BR BR-R					
RA RB	35 10	R-S S-R					Unit 2
E M	36 11	BK-BL BL-BK					
TA TB	38 13	BK-G G-BK					
RA RB	39 14	BK-BR BR-BK					Unit 3
E M	40 15	BK-S S-BK					

Table 50
NT5K83 E&M 4-Wire Type 5 connections for NT8D37
I/O panel connectors B, F, L, S (Part 1 of 2)

Lead Designations	Pin Numbers	Pair Colour	I/O Panel connector				Unit Number
Type 1 mode			B	F	L	S	
TA TB	26 1	W-BL BL-W	SLOT 1	SLOT 5	SLOT 9	SLOT 13	
RA RB	27 2	W-O O-W					Unit 0
E M	28 3	W-G G-W					
TA TB	30 5	W-S S-W					
RA RB	31 6	R-BL BL-R					Unit 1
E M	32 7	R-O O-R					
TA TB	34 9	R-BR BR-R					
RA RB	35 10	R-S S-R					Unit 2
E M	36 11	BK-BL BL-BK					
TA TB	38 13	BK-G G-BK					
RA RB	39 14	BK-BR BR-BK					Unit 3
E M	40 15	BK-S S-BK					

Table 50
NT5K83 E&M 4-Wire Type 5 connections for NT8D37
I/O panel connectors B, F, L, S (Part 2 of 2)

Lead Designations	Pin Numbers	Pair Colour	I/O Panel connector				Unit Number
Type 1 mode			B	F	L	S	
TA TB	42 17	Y-O O-Y	SLOT 2	SLOT 6	SLOT 10	SLOT 14	Unit 0
RA RB	43 18	Y-G G-Y					
E M	44 19	Y-BR BR-Y					
TA TB	46 21	V-BL BL-V					Unit 1
RA RB	47 22	V-O O-V					
E M	48 23	V-G G-V					

Table 51
NT5K83 E&M 4-Wire Type 2 connections for NT8D37 I/O panel connectors A,E,K,R

Pair	Pin Numbers	Pair Colour	I/O Panel connector				Unit Number
			A	E	K	R	
RA RB	26 1	W-BL BL-W	SLOT 0	SLOT 4	SLOT 8	SLOT 12	
TA TB	27 2	W-O O-W					Unit 0
E1 E2	28 3	W-G G-W					
M1 M2	29 4	W-BR BR-W					
RA RB	30 5	W-S S-W					
TA TB	31 6	R-BL BL-R					Unit 1
E1 E2	32 7	R-O O-R					
M1 M2	33 8	R-G G-R					
RA RB	34 9	R-BR BR-R					
TA TB	35 10	R-S S-R					Unit 2
E1 E2	36 11	BK-BL BL-BK					
M1 M2	37 12	BK-O O-BK					
RA RB	38 13	BK-G G-BK					
TA TB	39 14	BK-BR BR-BK					Unit 3
E1 E2	40 15	BK-S S-BK					
M1 M2	41 16	Y-BL BL-Y					

Table 52
NT5K83 E&M 4-Wire Type 2 connections for NT8D37 I/O panel connectors B, F, L, S (Part 1 of 2)

Pair	Pin Numbers	Pair Colour	I/O Panel connector				Unit Number
			B	F	L	S	
RA RB	26 1	W-BL BL-W	SLOT 1	SLOT 5	SLOT 9	SLOT 13	Unit 0
TA TB	27 2	W-O O-W					
E1 E2	28 3	W-G G-W					
M1 M2	29 4	W-BR BR-W					
RA RB	30 5	W-S S-W					Unit 1
TA TB	31 6	R-BL BL-R					
E1 E2	32 7	R-O O-R					
M1 M2	33 8	R-G G-R					
RA RB	34 9	R-BR BR-R					Unit 2
TA TB	35 10	R-S S-R					
E1 E2	36 11	BK-BL BL-BK					
M1 M2	37 12	BK-O O-BK					
RA RB	38 13	BK-G G-BK					Unit 3
TA TB	39 14	BK-BR BR-BK					
E1 E2	40 15	BK-S S-BK					
M1 M2	41 16	Y-BL BL-Y					

Table 52
NT5K83 E&M 4-Wire Type 2 connections for NT8D37
I/O panel connectors B, F, L, S (Part 2 of 2)

Pair	Pin Numbers	Pair Colour	I/O Panel connector				Unit Number
			B	F	L	S	
RA RB	42 17	Y-O O-Y	SLOT 2	SLOT 6	SLOT 10	SLOT 14	Unit 0
TA TB	43 18	Y-G G-Y					
E1 E2	44 19	Y-BR BR-Y					
M1 M2	45 20	Y-S S-Y					
RA RB	46 21	V-BL BL-V					Unit 1
TA TB	47 22	V-O O-V					
E1 E2	48 23	V-G G-V					
M1 M2	49 24	V-BR BR-V					

Table 53
NT5K83 E&M 4-Wire Type 2 connections for NT8D37 I/O panel connectors C, G, M, T (Part 1 of 2)

Pair	Pin Numbers	Pair Color	I/O Panel Connector				Unit Number
			C	G	M	T	
RA RB	26 1	W-BL BL-W	SLOT 2	SLOT 6	SLOT 10	SLOT 14	Unit 2
TA TB	27 2	W-O O-W					
E1 E1	28 3	W-G G-W					
M1 M2	29 4	W-BR BR-W					
RA RB	30 5	W-S S-W					Unit 3
TA TB	31 6	R-BL BL-R					
E1 E1	32 7	R-O O-R					
M1 M2	33 8	R-G G-R					

Table 53
NT5K83 E&M 4-Wire Type 2 connections for NT8D37
I/O panel connectors C, G, M, T (Part 2 of 2)

Pair	Pin Numbers	Pair Color	I/O Panel Connector				Unit Number
			C	G	M	T	
RA RB	34 9	R-BR BR-R	SLOT 3	SLOT 7	SLOT 11	SLOT 15	Unit 0
TA TB	35 10	R-S S-R					
E1 E1	36 11	BK-BL BL-BK					
M1 M2	37 12	BK-O O-BK					
RA RB	38 13	BK-G G-BK					Unit 1
TA TB	39 14	BK-BR BR-BK					
E1 E1	40 15	BK-S S-BK					
M1 M2	41 16	Y-BL BL-Y					
RA RB	42 17	Y-O O-Y					Unit 2
TA TB	43 18	Y-G G-Y					
E1 E1	44 19	Y-BR BR-Y					
M1 M2	45 20	Y-S S-Y					
RA RB	46 21	V-BL BL-V					Unit 3
TA TB	47 22	V-O O-V					
E1 E1	48 23	V-G G-V					
M1 M2	49 24	V-BR BR-V					

Self-test

When the NT5K83 E&M TIE trunk card is installed and power is applied to it, a self-test is performed on the card. The red LED on the faceplate flashes three times, then remains continuously lit until the card is enabled in software. If the self-test fails, the LED will remain lit after the card is enabled.

Technical description

Power requirements

Table 54 lists the power requirements for the NT5K83 E&M TIE trunk card.

Table 54
NT5K83 Power requirements

Voltage	Active Current
± 15.0 V dc	150 ma
- 15 V dc	160 ma
+8.5 V dc	35 ma
+ 5 V dc	110 ma
-48 V dc	80 ma

Environmental specifications

Table 55 provides the environmental specifications for the NT5K83 E&M TIE trunk card.

Table 55
NT5K83 Environmental specifications

Parameter	Absolute Limit
Operating temperature	10 to 45 ° C, ambient
Operating humidity	20 to 80% RH (non condensing)
Storage temperature	-20 to +60 ° C

Transmission parameters

Loss values for the NT5K83 E&M trunk card are given in the following Loss Plan Tables.

Table 56
NT5K83 4 Wire E&M trunk card

	ETSI	Existing
Loss A/D	0	0
Loss D/A	0	0

Table 57
Recorded Announcement/Music

	ETSI	Existing
Loss A/D	0	4

Table 58
Paging

	ETSI	Existing
Loss D/A	3	-3

Trunk types description

Each unit on the NT5K83 E&M TIE trunk card supports:

— 4-wire E&M trunk type 5 and 2

— Recorded Announcement (RAN) trunk

— Paging (PAG) trunk

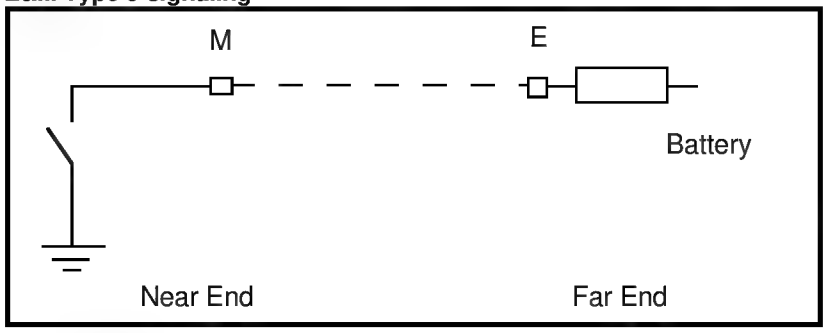
— Music (MUS) trunk

For information on features and signaling arrangements, see *Generic X11 Including Supplementary Features* (PO730484).

4-wire E&M Type 5 trunk operation

Type 5 E&M operation uses two signaling leads, E and M, that are electrically separated from the associated speech circuit. Signals are sent on the M lead and received on the E lead as shown in Figure 1.

Figure 1
E&M Type 5 signaling



Send signals

All signals are sent in the form of a contact between M and ground or an open circuit between M and ground.

Receive signals

Signals are received on the E lead by detecting the conditions applied to the M lead by the far end.

Idle state

In the Idle state, the M lead receives an "Idle signal" from the Meridian 1 and is ready to receive calls.

Seize

To place an outgoing call, the Meridian 1 at the near end sends a seizing signal through the M lead to the far end. The incoming end recognizes the seize signal and prepares to receive digits.

Dialing

Digits are sent through the near end M lead in the form of 10 pps pulses of the open-circuit condition.

Answer

When the called party answers, the far end sends an "answer" signal through the M lead.

Call disconnect

Either party can disconnect the call by applying a clear signal to the M lead. The far end applies a "clear back" signal, while the near end applies a "clear forward" signal. The circuit remains busy until both clear forward and clear backward signals have been exchanged.

Table 59 provides a summary of NT5K83 DC-5 signaling states.

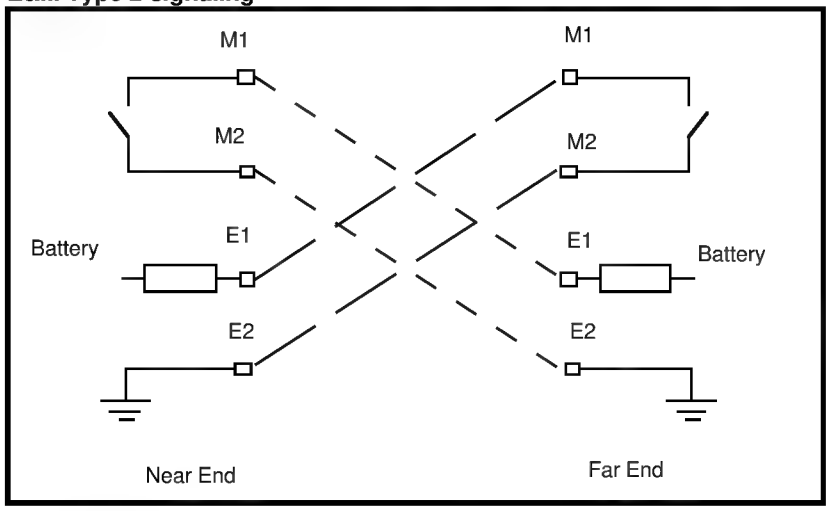
Table 59
Summary of NT5K83 DC-5 signaling states

Signal	Outgoing PBX sending condition — M Wire	Incoming PBX sending condition — M Wire
Idle	Open circuit	Open circuit
Seize	ground	—
Digit Pulse	Open circuit pulses in step with dial pulses	—
Answer	—	Ground
Clear forward	Open circuit longer than 300 ms	—
Clear back	—	Open circuit for longer than 300 ms

4-wire E&M Type 2 trunk operation

Type 2 E&M operation uses two signaling pairs, E and M, that are electrically separated from the associated speech circuit. Signals are sent on the M pair and received on the E pair as shown in Figure 2.

Figure 2
E&M Type 2 signaling



Send signals

All signals are sent in the form of a contact make or break between the two M leads. In the make state there is a maximum of 200 ohms between the two M leads. In the break state there is a minimum of 100 kilo-ohms between the M leads.

Receive signals

Signals are received on the E lead by detecting the contact make or break applied at the far-end on the M leads.

Idle state

In the Idle state the Meridian 1 applies an "idle signal" to the M leads to indicate that it is available to receive calls.

Seize

To place an outgoing call, the Meridian 1 at the near end sends a seizing signal through the M leads to the far end. The incoming end (far end) recognizes the seize signal, busies the circuit against outgoing calls, and prepares to receive digits.

Dialing

Digits are sent through the near end M leads in the form of 10 pps pulses of the open-circuit condition.

Answer

When the called party answers, the far end sends an "answer" signal through the M leads.

Call disconnect

Either party can disconnect the call by applying a clear signal to the M leads. The far end applies a "clear back" signal, while the near end applies a "clear forward" signal. The circuit remains busy until both clear forward and clear backward signals have been exchanged.

Table 60 provides a summary of NT5K83 DC-5 Type 2 signaling states.

Table 60
Summary of NT5K83 DC-5 Type 2 signaling states

Signal	Outgoing PBX sending condition — M Leads	Incoming PBX sending condition — M Leads
Idle	Contact break	Contact break
Seize	Contact make	—
Digit Pulse	Contact break pulses in step with dial pulses	—
Answer	—	Contact make
Clear forward	Contact break for longer than 300 ms	—
Clear back	—	Contact break for longer than 300 ms

Recorded Announcement/Music trunk operation

When used in the Recorded Announcement/Music mode, the trunk circuit is connected to a customer provided recorded announcement machine or a music source.

The NT5K83 E&M TIE trunk card supports the following types of announcement machines:

— Start mode announcement machines:
(for example, Code-A-Phone and Viking DVA-1003A)

— Continuous mode announcement machines
(for example, Audichron)

Start mode

In start mode, the E&M TIE trunk card provides a startpulse to the announcement machine to begin playback of the message. The announcement source requires the following:

— an impedance of 4 ohms or less

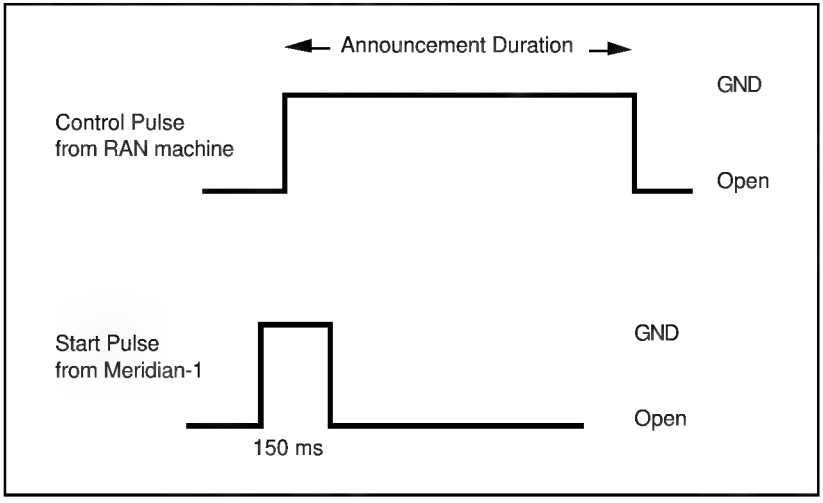
— ground to the trunk unit when playing and an open circuit when idle. This is done through a control lead to the trunk circuit.

— default signal level of -9 dBm (in 600 ohms) adjustable to a level of 10 dBm.

To start the announcement, the NT5K83 E&M TIE trunk card provides a momentary ground signal (150 ms) to the source. The announcement machine should then start playing its message.

The NT5K83 trunk card expects status information from the announcement machine, that is, whether it is idle or playing. For this reason, the announcement machine requires a control lead to the trunk circuit.

Figure 3
Recorded announcement - start mode



Continuous mode

The requirements for continuous mode announcement machines are as follows:

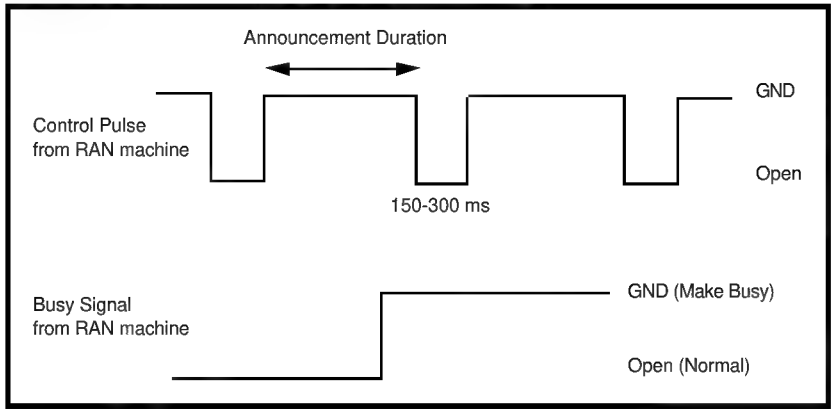
— an impedance of 4 ohms or less

— generation of a control pulse (150 - 300 ms) at the start of the announcement period

— default signal level of -9 dBm (in 600 ohms) adjustable to a level of 10 dBm.

The announcement machine may provide a separate busy signal when the machine is recording or erasing a message or if the machine is malfunctioning. The busy signal will be used by the Meridian 1 for maintenance purposes.

Figure 4
Recorded announcement - continuous mode



Music source

The music source should provide an impedance of 600 ohms. The default signaling level should be -9 dBm (in 600 ohms) adjustable to a level of 10 dBm.

Paging trunk operation

When used in the paging mode, the trunk circuit is connected to a customer-provided paging amplifier system. When accessed, the card provides a loop closure. In a typical application, the loop closure will cut off a music supply and switch the paging trunk transmission path to the paging amplifier.

Tone detector circuit card — NT5K48

Functional description

The NT5K48AB Tone Detector circuit card provides tone detection for either Dual Tone Multifrequency (DTMF) or Dial Tone (DT). It can be installed in any PE slot that supports Intelligent Peripheral Equipment (IPE).

Common features

The NT5K48AB Tone Detector circuit card:

- provides eight channels of tone detection configurable on a call-connection basis for either DTMF or DT detection
- is configurable on a call connection basis to provide both first stage Dial Tone Detection (DTD) and second stage DTD

  Note: The NT5K48AB Tone Detector remains dedicated to the call while the connecting process is progressing. Once the call is connected, the NT5K48AB Tone Detector is released: it will not detect dial tone after the call is established.

- supports both A-Law and μ-Law companding
- provides card-identification for auto configuration, and for determining the serial number and firmware level of the card
- provides for hardware self test
- allows country specific DTMF and dial tone characteristics to be downloaded from software.

Physical description

Switch settings

There are no option switches on the NT5K48AB Tone Detector circuit card. All settings are configured in software.

Self-test

When the NT5K48AB Tone Detector circuit card is installed and power is applied to it, a self-test is performed on the card. The red LED on the NT5K48AB faceplate flashes three times, then remains continuously lit until the card is enabled in software, after which it is extinguished. If the self-test fails, the LED will remain lit after the card is enabled.

Technical description

Power requirements

The NT5K48AB Tone Detector has a maximum current draw of 1.5 amps at 5 V.

Environmental specifications

Table 9 lists the environmental specifications of the NT5K48AB Tone Detector circuit card.

Table 61
NT5K48AB circuit card environmental specifications

Parameter	Specifications
Operating temperature	0° to 45° C, ambient
Operating humidity	5 to 95% Relative Humidity
Storage temperature	- 40° to + 70°C

Dial tone detection

The NT5K48ABBA Tone Detector circuit card is designed for use in CIS.

First stage dial tone detection

The following dial tone characteristics are supported by the NT5K48AB Tone Detector circuit card used in CIS.

- First stage dial tone frequency detection band (DFQ)
- Band A (DFQ 1)350 Hz through 500 Hz
- Minimum Detect Level (MDL)

— 10 dBmO through -40 dBmO in decrements of 2 dB

- Minimum Validation Time (MVT)

— durations of 100 ms through 1600 ms in increments of 100 ms

- Break duration of continuous tone not cadenced (BRK)

— 0 ms through 240 ms in increments of 16 ms

- Cadence type (CAD)

— 0 (continuous tone)

Second stage dial tone detection

Second stage dial tone detection allows the NT5K48AB Tone Detector to interrupt digit outpulsing until a second dial tone is detected. The characteristics of the tone detected are as defined for the first stage dial tone.

Note: Second stage dial tone is not usually used in CIS.

Country specific tone detection

The NT5K48AB Tone Detector is designed for use in CIS. It can be set to the characteristics of country specific tones by using overlay 97.

The XTD (NT5K48AB) pack is backward compatible from 8B software to 7C software. It is not, however, backward compatible to 7B software. Aspecific XTD pack is required for 7B software (NT5K48DA pack).

The minimum accepted level for the XTD is -30 dBm and the maximum reject level is -40 dBm for Dial Tone. The present minimum detect level (MDL) used in overlay 97 is -32 dBmO.

For ETSI Mode, the XFCOT will decrease the level of the dial tone by 4 dB. The new minimum detect level (MDL in overlay 97) needed to meet ETSI requirements should be -34 dBmO.

CIS

Typical settings for CIS are shown in Table 62 below.

Table 62
NT5K48 Tone detection table

Characteristic	Mnemonic	Setting
Frequency Band	DFQ	1
Minimum Detect Level	MDL	-34 dBm0
Minimum Validation Time	MVT	1500 ms
Break Tolerance	BRK	000 ms
Cadence Type	CAD	00
Second Stage Configuration	SSC	See Note
Minimum Acceptance Level	MINL	-45 dBm

Note: Second Stage Configuration allows the definition of second stage dial tone. Second stage dial tone detection is not normally required in the CIS.

Refer to the *X11 Input/Output Guide* 553-3001-400 for more detailed information about use of overlay programs.

Digital Line Card — NT8D02

Description

In Meridian 1 Option 11 systems the NT8D02AB Digital Line Card is installed in slots 1 through 9 of the NTAK11 main cabinet, and in slots 11 through 20 in the NTAK12 expansion cabinet. In Option 11 systems equipped with Meridian Mail, the line card cannot be installed in slot 10 of the main cabinet.

The NT8D02 Digital Line Card is a voice and data communication link between the system and modular digital telephones. It supports voice only or simultaneous voice and data service over a single twisted pair of standard telephone wiring.

When a digital telephone is equipped with the data option, an asynchronous ASCII terminal or personal computer can be connected to the system through the digital telephone.

Physical

The digital line card circuitry is contained on a 320 mm (12.5 in.) by 254 mm (10 in.) double-sided printed circuit board. The card connects to the backplane through a 120-pin edge connector.

The faceplate of the digital line card is equipped with a red light emitting diode (LED) which lights when the card is disabled. At power-up, the LED flashes as the digital line card runs a self-test. If the test completes successfully, the card is automatically enabled (if it is configured in software) and the LED goes out.

Functional

The digital line card is equipped with 16 identical units. Each unit provides a multiplexed voice, data, and signaling path to and from digital apparatus over a 2-wire full duplex 512 kHz time compression multiplexed (TCM) digital link. Each digital telephone and associated data terminal is assigned a separate terminal number (TN) in the system database, for a total of 32 addressable ports per card.

The digital line card contains a microprocessor that provides the following functions:

— self-identification

— self-test

— control of card operation

— status report to the controller

— maintenance diagnostics

Technical summary

Table 63 provides a technical summary of the digital line card.

Table 63
NT8D02 Digital Line Card technical summary

Characteristics	Description
Units per card	16 voice, 16 data
Impedance	100 Ω
Loop limits	30 m (100 ft) to 915 m (3000 ft) with 24 AWG PVC cable (±15 V DC at 80 mA)
	0 to 1070 m (3500 ft) with 24 AWG PVC cable (±15 V DC at 80 mA)
Line rate	512 kbps ± 100 ppm
Power supply	+ 5 V DC ±15 V DC +10 V DC
Transmitter output voltage:	
— successive "1" bits	+1.5 ± 0.15 V and -1.5 ± 0.15 V
— "0" bits	0 ± 50 mV

Power requirements

The digital line card needs ±15V DC over each loop at a maximum current of 80 mA. It requires +15V, - 15V, and +5V from the backplane. The line feed interface can supply power to one loop of varying length up to 1070 m (3500 ft) using 24 AWG wire with a maximum allowable AC signal loss of 15.5 dB at 256 kHz, and a maximum DC loop resistance of 210 ohms; 26 AWG wire is limited to 745 m (2450 ft).

Foreign and surge voltage protections

In-circuit protection against power line crosses or lightning is not provided on the Digital line card.

Analog Message Waiting Line Card — NT8D09

Description

The NT8D09 Analog Message Waiting Line Card (μ-Law) provides talk battery and signaling for regular 2-wire common battery 500-type (rotary dial) and 2500-type (Digitone dial) telephones and key telephone equipment.

The analog message waiting line card is functionally identical to the NT8D03 Analog Line Card, except that it can also connect a high-voltage, low-current feed to each line to light the message waiting lamp on telephones equipped with the Message Waiting feature.

The analog message waiting line card interfaces to and is compatible with the equipment listed in Table 64.

Table 64
NT8D09 Analog Message Waiting Line Card application and compatibility

Equipment	Specifications
500 type rotary dial sets (or equivalent):	
dial speed	8.0 to 12.5 pps
percent break	58 to 70%
interdigital time	150 ms
2500 type Digitone sets (or equivalent):	
frequency accuracy	± 1.5%
pulse duration	40 ms
interdigital time	40 ms
speed	12.5 digits/s

Physical

In Meridian 1 Option 11 systems the NT8D09AD Analog Message Waiting Line Card is installed in slots 1 through 9 of the NTAK11 main cabinet, and in slots 11 through 20 in the NTAK12 expansion cabinet. In Option 11 systems equipped with Meridian Mail, the line card cannot be installed in slot 10 of the main cabinet.

The line card circuits connects to the backplane through a 160-pin connector. The backplane is cabled to a connector in the bottom of the cabinet which is cabled to the cross-connect terminal (main distribution frame) through 25-pair cables. Station apparatus then connects to the card at the cross-connect terminal.

The faceplate of the analog message waiting line card is equipped with a red light emitting diode (LED) which lights when the card is disabled. At power-up, the LED flashes as the analog line card runs a self-test. If the test completes successfully, the card is automatically enabled (if it is configured in software) and the LED goes out.

Functional

The analog message waiting line card contains a microprocessor that provides the following functions:

— self-identification

— self-test

— control of card operation

— status report to the controller

— maintenance diagnostics

The analog message waiting line card also provides:

— 600 ohm balanced terminating impedance

— analog-to-digital and digital-to-analog conversion of transmission and reception signals for 16 audio phone lines

— transmission and reception of scan and signaling device (SSD) signaling messages over a DS30X signaling channel in A10 format

— on-hook/off-hook status and switchhook flash detection

— 20 Hz ringing signal connection and automatic disconnection when the station goes off-hook

— synchronization for connecting and disconnecting the ringing signal to zero crossing of ringing voltage

— loopback of SSD messages and pulse code modulation (PCM) signals for diagnostic purposes

— correct initialization of all features at power-up

— direct reporting of digit dialed (500-type telephones) by collecting dial pulses

— connection of -150 V DC at 1 Hz to activate message waiting lamps

— lamp status detection

— disabling and enabling of selected units for maintenance.

Technical summary

Analog line interface

Input impedance

The impedance at tip and ring is 600 ohms with a return loss of

— 20 dB for 200–500 Hz

— 26 dB for 500–3400 Hz

Insertion loss

On a station line-to-line connection, the total insertion loss at 1 kHz is 6 dB $\pm$ 1 dB. This is arranged as 3.5 dB loss for analog to PCM, and 2.5 dB loss for PCM to analog.

Frequency response

The loss values in Table 65 are measured relative to the loss at 1 kHz.

Table 65
NT8D09 Analog Message Waiting Line Card frequency response

Frequency	Minimum	Maximum
60 Hz	20.0 dB	--
200 Hz	0.0 dB	5.0 dB
300 Hz	-0.5 dB	1.0 dB
3000 Hz	-0.5 dB	1.0 dB
3200 Hz	-0.5 dB	1.5 dB
3400 Hz	0.0 dB	3.0 dB

Message channel noise

The message channel noise C-weighted (dBrnC) on 95 percent of the connections (line to line) with both ends terminated in 600 ohms does not exceed 20 dBrnC.

Table 66 provides a technical summary of the analog message waiting line card.

Table 66
NT8D09 Analog Message Waiting Line Card technical summary

Impedance	600 Ω
Loop limit (excluding set)	1000 Ω at nominal -48 V (excluding set)
Leakage resistance	30,000 Ω
Ring trip	During silent or ringing intervals
Ringing voltage	86 V AC
Signaling	Loop start
Supervision	Normal battery conditions are continuously applied (approximately -44.5 V on ring and -2.5 V on tip at nominal -48 V battery)
Power input from backplane	-48 (can be as low as -42 for DC-powered systems), +15, -15, +8.5 V and ringing voltage; also -150 V on analog message waiting line card.
Insertion loss	6 dB ± 1 dB at 1020 Hz 3.5 dB loss for analog to PCM, 2.5 dB loss for PCM to analog

Power requirements

Table 67 provides the power requirements for the analog message waiting line card.

Table 67
Power requirements

Voltage (+/-)	Tolerance	Idle current	Active current	Max
+ 12.0 V DC	0.36 V DC	48 mA	0 mA	48 mA
+ 8.0 V DC	0.40 V DC	150 mA	8 mA	280 mA
- 48.0 V DC	2.00 V DC	48 mA	40 mA	688 mA
- 48.0 V DC	5.00 V DC	0 mA	10 mA (Note 1)	320 mA
86.0 V AC	5.00 V AC	0 mA	10 mA (Note 2)	160 mA
-150.0 V DC	3.00 V DC	0 mA	2 mA	32 mA

Note 1: Each active ringing relay requires 10 mA of battery voltage.

Note 2: Reflects the current for ringing a single station set. There may be as many as five ringers on each line.

Foreign and surge voltage protections

In-circuit protection against power line crosses or lightning is not provided on the Analog Message Waiting line card. When the Analog line card is used to service off-premise telephones, the NTAK92 off-premise protection module must be used. Check local regulations before providing such service.

Overload level

Signal levels exceeding +7 dBm applied to the tip and ring cause distortion in speech transmission.

Universal Trunk Card — NT8D14

Functional description

The Universal Trunk Card:

— allows trunk type to be configured on a per unit basis

— indicates status during an automatic or manual self-test

— provides card-identification for auto configuration, and to determine the serial number and firmware level of the card

— converts transmission signals from analog-to-digital/digital-to-analog

— operates in A-Law or μ-Law companding modes on a per unit basis

— provides software selected terminating impedance (600, 900, or 1200 ohm) on a per unit basis (1200 ohm supported for RAN trunks only)

— provides software selected balance impedance (600 ohm or complex impedance network) on a per unit basis

— interfaces eight PCM signals to one DS-30X timeslot in A10 format

— transmits and receives SSD signaling messages over a DS-30X signaling channel in A10 format

— supports PCM signal loopback to DS-30X for diagnostic purposes.

Trunk types supported

The Universal Trunk Card has eight identical units. You configure the trunk type of each unit independently in the Trunk Data Block (LD 14). The card supports the following types of trunks:

— Central Office (CO), Foreign Exchange (FX), and Wide Area Telephone Service (WATS)

— Direct Inward Dial (DID) and Direct Outward Dial (DOD)

— TIE Two-way Dial Repeating (DR) and Two-way Outgoing Automatic Incoming Dial (OAID)

— Paging (PAG)

Note: All-call zone paging is not supported.

— Recorded Announcement (RAN).

The Universal Trunk Card also supports Music, Automatic Wake Up, and Direct Inward System Access (DISA).

Table 68 is a matrix of the trunk types and signaling supported by the Universal Trunk Card.

Table 68
Supported trunk type and signaling matrix

	CO/FX WATS	DID/ DOD	Tie	PAG	RAN
Loop start	yes	no	no	no	no
Ground start	yes	no	no	no	no
Loop dial repeating	no	yes	yes	no	no
Loop OAID	no	no	yes	no	no

Microprocessor

The Universal Trunk Card is equipped with a microprocessor which controls card operation. The microprocessor also provides the communication function for the card.

The Universal Trunk Card communicates with the Controller Card through a serial communication link. Features provided through the link include:

— card-identification

— self-test status reporting

— status reporting to the Controller Card

— maintenance diagnostics.

Signalling and control

The signaling and control portion of the Universal Trunk Card works with the CPU to operate the card hardware. The card receives messages from the CPU over a signaling channel in the DS-30X loop and returns status information to the CPU over the same channel. The signaling and control portion of the card provides the means for analog loop terminations to establish, supervise, and take down call connections.

Signalling interface

All trunk signaling messages are three bytes long. The messages are transmitted in channel zero of the DS-30X in A10 format.

Configuration information for the Universal Trunk Card is downloaded from the CPU at power-up or by command from maintenance programs. Eleven configuration messages are sent. Three messages are sent to the card to configure the make/break ratio and A-Law or μ-Law operation. One message is sent to each unit to configure the trunk characteristics.

Electrical characteristics

Electrical characteristics of the Universal Trunk Card are listed in Table 69.

Table 69
Universal Trunk Card electrical characteristics

Characteristic	DID trunk	CO trunk
Terminal impedance	600 or 900 Ω (selected by software)	600 or 900 Ω (selected by software)
Signaling range	2450 Ω	1700 Ω
Signaling type	Loop start	Ground or loop start
Far end battery	- 42 to - 52.5 V	- 42 to - 52.5 V
Near end battery	N/A	- 42.75 to - 52.5 V
Minimum loop current	N/A	20 mA
Ground potential difference	±3 V	±3 V
Low DC loop resistance during outpulsing	N/A	< 300 Ω
High DC loop resistance	N/A	Ground start equal to or greater than 30 kΩ; loop start equal to or greater than 5 MΩ
Line leakage	Equal to or greater than 30 kΩ (tip to ring, tip to ground, ring to ground)	Equal to or greater than 30 kΩ (tip to ring, tip to ground, ring to ground)
Effective loss	See PAD switching	See PAD switching

Physical characteristics

In Meridian 1 Option 11 systems the NT8D14 Universal Trunk Card is installed in slots 1 through 10 of the NTAK11 main cabinet, and in slots 11 through 20 in the NTAK12 expansion cabinet.

In Option 11 systems equipped with Meridian Mail, the Universal Trunk card cannot be installed in slot 10 of the main cabinet.

When the card is installed, the red Light Emitting Diode (LED) on the faceplate flashes as the self-test runs. If the self-test completes successfully, the card is automatically enabled (if it is configured in software) and the LED goes out. If the self-test fails, the LED lights steadily and remains lit. The LED will also light and remain lit if one or more units on the card becomes disabled after the card is operating.

Each unit on the card connects to the backplane through an 80-pin connector, the backplane is cabled to the Input/Output (I/O) panel, and the I/O panel is cabled to the cross-connect terminal.

At the cross-connect terminal, each unit connects to external apparatus, such as Central Office facilities or recorded announcement equipment. Each unit connects to external apparatus by tip and ring leads which carry voice, ringing, tone signaling, and battery.

Power requirements

Power requirements for the Universal Trunk Card are specified in Table 70.

Table 70
Power requirements

Voltage	Tolerance	Idle current	Active current
± 15.0 V DC	± 5%	306 ma	306 ma
+ 8.5 V DC	± 2%	120 ma	120 ma
- 48.0 V DC	± 5%	346 ma	346 ma
+ 5.0 V DC	± 10%	350 ma	350 ma

Environmental specifications

Table 71 lists the environmental specifications for the Universal Trunk Card.

Table 71
Environmental specifications

Parameter	Specifications
Operating temperature	0° to 50° C, ambient
Operating humidity	5 to 95% RH (non-condensing)
Storage temperature	- 40° to + 70° C

Foreign and surge voltage protection

The Universal Trunk Card meets CS03 overvoltage (power cross) specifications.

Release control

Release control establishes which end of a call (near, far, either, joint, or originating) disconnects the call. Only incoming trunks in idle ground start configuration can provide disconnect supervision. You configure release control for each trunk independently in the Route Data Block (LD 16).

PAD switching

The transmission properties of each trunk are characterized by the Class of Service (COS) you assign in the Trunk Data Block (LD 14). Transmission properties may be via net loss (VNL) or non via net loss (non-VNL).

Non-VNL trunks are assigned either a Transmission Compensated (TRC) or Non-Transmission Compensated (NTC) Class of Service to ensure stability and minimize echo when connecting to long-haul trunks, such as Tie trunks. The Class of Service determines the operation of the switchable PADs contained in each unit. They are assigned as follows:

— Transmission Compensated

- used for a two-wire non-VNL trunk facility with a loss of greater than 2 dB for which impedance compensation is provided
- or used for a four-wire non-VNL facility

— Non-Transmission Compensated

- used for a two-wire non-VNL trunk facility with a loss of less than 2 dB
- or used when impedance compensation is not provided

Table 72 shows PAD settings and the resulting port-to-port loss for connections between the Universal Trunk Card (UTC) and any other Intelligent Peripheral Equipment (IPE) or Peripheral Equipment (PE) unit, denoted as Port B

In Option 11 systems, the insertion loss from IPE ports to IPE ports is as follows.

Table 72
Insertion Loss from IPE Ports to IPE Ports (measured in dB)

	IPE Ports				
IPE Ports ↑ ↓	**500/2500 Line**	**Digital Line**	**2/4 Wire E&M Trunk**	**4 Wire (ESN) E&M Trunk**	**CO/FX /WATS Loop Tie Trunk**
CO/FX/WATS Loop Tie Trunk					
→	2.5	0	0.5	0	0.5
←	0	-3.5	0	-0.5	0.5

Application

The optional applications, features, and signaling arrangements for each trunk are assigned through unique route and trunk data blocks.

Loop start operation

Loop start operation is configured in software and is implemented in the card through software download messages. When the Universal Trunk is idle, it provides a high impedance toward the CO for isolation and AC detection. The alerting signal is 20 Hz ringing sent by North American CO. When an incoming call is answered, ringing is tripped when the trunk places a low resistance DC loop towards the CO.

For outgoing calls from a telephone set or attendant console, software sends an outgoing seizure message to place a low resistance loop across the tip and ring leads towards the CO. When the CO is ready to receive digits, it returns dial tone. The outward address signaling is applied from the system in the form of DTMF tones or dial pulses.

Ground start operation

Ground start operation is configured in software and implemented through software download messages. In an idle state, the tip conductor from the CO is open and a high resistance negative battery is present on the tip of the trunk. This biases the tip ground detector OFF until the CO places ground on the tip at seizure. After the tip ground is detected, the Universal Trunk Card scans for a ringing detection signal before presenting the call to an attendant and tripping the ringing. A low resistance is placed across the tip and ring conductors and a speech path is established.

Direct Inward Dial operation

An incoming call from the CO places a low resistance loop across the tip and ring leads. Dial pulses or DTMF signals are then presented from the CO. When the call is presented and the terminating party answers, the Universal Trunk Card reverses battery and ground on the tip and ring leads to the CO. The trunk is arranged for first party release. The CO releases the trunk by removing the low resistance loop and normal battery and ground are restored at the system.

Tie Two-way Dial Repeating operation

In an incoming call configuration, the far end initiates a call by placing a low resistance loop across the tip and ring leads. This causes a current to flow through the battery feed resistors in the trunk circuit. Address signaling is then applied by the far end in the form of DTMF tones or dial pulses. When the called party answers, an answer supervision signal is sent by software, causing the trunk to reverse battery and ground signals to the far end. The far end then removes the low resistance loop and normal battery and ground are restored at the system.

In an outgoing call configuration, the Universal Trunk is connected to another PBX by a Tie trunk. An outgoing call from the system seizes the trunk facility by placing a low resistance loop across the tip and ring leads. Outward addressing is then applied from the system in the form of DTMF tones or dial pulses (battery/ground pulsing). If answer supervision is provided by the far end, reverse battery is received, which provides a disconnect supervision signal.

Tie Outgoing Automatic Incoming Dial operation

When the Universal Trunk is seized by the far end on an incoming call, a low resistance loop is placed across the tip and ring leads. Dial pulses are sent by the far end by interrupting the loop current. The trunk is released at the far end when the loop is opened. When it detects an open loop, the near end reverts to a normal state.

When seized as a dial-selected outgoing trunk, the Universal Trunk places battery on the tip and ground on the ring. This alerts the far end of the seizure. The far end responds with a low resistance across the tip and ring leads.

Recorded Announcement operation

In this mode of operation, the Universal Trunk is connected to a digital announcement machine. The announcer provides a number of channels and operates in a continuous mode, generating 150–300 ms common control pulses every 7 or 14 seconds (at the start of the announcement period). A number of trunks can be connected to one announcement machine.

The Universal Trunk Card does not support the Code-A-Phone 210DC announcement recorder.

Paging operation

In the Paging mode, the Universal Trunk is connected to a customer-provided paging amplifier system. When the trunk is accessed by dial-up or attendant key operation, it provides a loop closure across control leads A and B. In a typical application, this will transfer the input of the paging amplifier system to the transmission path of the trunk.

XMFC/MFE card — NT5K21

Overview

The XMFC/MFE (Extended Multi-frequency Compelled/Multi-frequency sender-receiver) card is used to set up calls between two trunks. Connections may be between a PBX and a CO or between two PBXs. When connection has been established, the XMFC/MFE card sends and receives pairs of frequencies and then drops out of the call.

The XMFC/MFE card can operate in systems using either A-law or μ-law companding by changing the setting in software.

MFC signalling

The MFC feature allows the Option 11 system to use the CCITT MFC R2 or L1 signaling protocols.

Signalling levels

MFC signaling uses pairs of frequencies to represent digits, and is divided into two levels:

Level I: used when a call is first established and may be used to send the dialed digits.

Level II: used after Level 1 signaling is completed and may contain such information as the status, capabilities, or classifications of both calling parties.

Forward and backward signals

When one NT5K21 XMFC/MFE card sends a pair of frequencies to a receiving XMFC/MFE card (forward signaling), the receiving XMFC/MFE card must respond by sending a different set of frequencies back to the originating XMFC/MFE card (backward signaling). In other words, the receiving card is always "compelled" to respond to the originating card.

In summary, the signaling works as follows:

— The first XMFC/MFE card sends a forward signal to the second card.

— The second card hears the forward signal and replies with a backward signal.

— The first card hears the backward signal and "turns off" its forward signal.

— The second card hears the forward signal being removed and removes its backward signal.

— The first XMFC/MFE can either send a second signal or drop out of the call.

MFC signaling involves two or more levels of forward signals and two or more levels of backward signals. Separate sets of frequencies are used for forward and backward signals:

— **Forward signals.** Level I forward signals are dialed address digits that identify the called party. Subsequent levels of forward signals describe the category (Class of Service) of the calling party, and may include the calling party status and identity.

— **Backward signals.** Level I backward signals (designated 'A') respond to Level I forward signals. Subsequent levels of backward signals (B, C, and so on) describe the status of the called party.

Table 73 lists the frequency values used for forward and backward signals.

Table 73
MFC Frequency values

Digit	Forward direction DOD-Tx, DID-Rx	backward direction DOD-Rx, DID-Tx
1	1380 Hz + 1500 Hz	1140 Hz + 1020 Hz
2	1380 Hz + 1620 Hz	1140 Hz + 900 Hz
3	1500 Hz + 1620 Hz	1020 Hz + 900 Hz
4	1380 Hz + 1740 Hz	1140 Hz + 780 Hz
5	1500 Hz + 1740 Hz	1020 Hz + 780 Hz
6	1620 Hz + 1740 Hz	900 Hz + 780 Hz
7	1380 Hz + 1860 Hz	1140 Hz + 660 Hz
8	1500 Hz + 1860 Hz	1020 Hz + 660 Hz
9	1620 Hz + 1860 Hz	900 Hz + 660 Hz
10	1740 Hz + 1860 Hz	780 Hz + 660 Hz
11	1380 Hz + 1980 Hz	1140 Hz + 540 Hz
12	1500 Hz + 1980 Hz	1020 Hz + 540 Hz
13	1620 Hz + 1980 Hz	900 Hz + 540 Hz
14	1740 Hz + 1980 Hz	780 Hz + 540 Hz
15	1860 Hz + 1980 Hz	660 Hz + 540 Hz

The exact meaning of each MFC signal number (1–15) within each level can be programmed separately for each trunk route using MFC. This programming can be done by the customer and allows users to suit the needs of each MFC-equipped trunk route.

Each MFC-equipped trunk route is associated with a data block that contains the MFC signal functions supported for that route. Up to 127 such tables can be defined for an Option 11 system.

MFE signalling

The NT5K21 XMFC/MFE card can be programmed for MFE signaling which is used mainly in France. MFE is much the same as MFC except it has its own set of forward and backward signals.

Table 74 lists the forward and backward frequencies for MFE. The one backward signal for MFE is referred to as the "control" frequency.

Table 74
MFE Frequency values

Digit	Forward direction OG-Tx, IC-Rx	Backward direction
1	700 Hz + 900 Hz	1900 Hz (Control Frequency)
2	700 Hz + 1100 Hz	—
3	900 Hz + 1100 Hz	—
4	700 Hz + 1300 Hz	—
5	900 Hz + 1300 Hz	—
6	1100 Hz + 1300 Hz	—
7	700 Hz + 1500 Hz	—
8	900 Hz + 1500 Hz	—
9	1100 Hz + 1500 Hz	—
10	1300 Hz + 1500 Hz	—

Sender and receiver mode

The XMFC/MFE circuit card provides the interface between the Option 11 CPU and the trunk circuit which uses MFC or MFE signaling.

The XMFC/MFE circuit card transmits and receives forward and backward signals simultaneously on two channels. Each channel is programmed like a peripheral circuit card unit, with its own sending and receiving timeslots in the Meridian network.

Receive mode

When in receive mode, the XMFC/MFE card is linked to the trunk card by a PCM speech path over the Meridian network cards. MFC signals coming in over the trunks are relayed to the XMFC/MFE card as though they were speech. The XMFC/MFC card interprets each tone pair and sends the information to the CPU through the CPU bus.

Send mode

When in send mode, the CPU sends data to the XMFC/MFE card through the CPU bus. The CPU tells the XMFC/MFE card which tone pairs to send and the XMFC/MFE card generates the required tones and sends them to the trunk over the PCM network speech path. The trunk transmits the tones to the far end.

XMFC sender and receiver specifications

Tables 75 and 76 provide the operating requirements for the NT5K21 XMFC/MFE card. These specifications conform to CCITT R2 recommendations: Q.441, Q.442, Q.451, Q.454, and Q.455.

Table 75
XMFC sender specifications

Forward frequencies in DOD mode:	1380, 1500, 1620, 1740, 1860, 1980 Hz
Backward frequencies in DOD mode:	1140, 1020, 900, 780, 660, 540 Hz
Frequency tolerance:	± 0.5 Hz from nominal
Power level at each frequency:	Selectable: 1 of 16 levels
Level difference between frequencies:	< 0.5 dB
Harmonic Distortion and Intermodulation	37 dB below level of 1 signaling frequency
Time interval between start of 2 tones:	125 µsec.
Time interval between stop of 2 tones:	125 µsec.

Table 76
XMFC receiver specifications

Input sensitivity:	
accepted:	-5 to -31.5 dBmONew CCITT spec.
rejected:	-38.5 dBmOBlue Book
Bandwidth twist:	
accepted:	fc ± 10 Hz
rejected:	fc ± 60 Hz
Amplitude twist:	
accepted:	difference of 5 dB between adjacent frequencies difference of 7 dB between non-adjacent frequencies
Norwegian requirement	difference of 12 dB (for unloaded CO trunks)
rejected:	difference of 20 dB between any two frequencies
Operating time:	< 32 msec.
Release time:	< 32 msec.
Tone Interrupt no release:	< 8 msec. Receiver on, while tone missing
Longest Input tone ignored:	< 8 msec. Combination of valid frequencies
Noise rejection:	S/N > 18 dB No degradation, in band white noise S/N > 13 dB Out-of-band disturbances for CCITT

XMFE sender and receiver specifications

Tables 77 and 78 provide the operating requirements for the XMFC/MFE card when it is configured as an XMFE card. These requirements conform to French Socotel specifications ST/PAA/CLC/CER/692.

Table 77
XMFE sender specifications

Forward frequencies in OG mode:	700, 900, 1100, 1300, 1500 Hz
Forward frequencies in IC mode:	1900 Hz
Frequency tolerance:	± 0.25% from nominal
Power level at each frequency:	Selectable: 1 of 16 levels
Level tolerance:	± 1.0 dB
Harmonic Distortion and Intermodulation:	35 dB below level of 1 signaling frequency
Time interval between start of 2 tones:	125 µsec.
Time interval between stop of 2 tones:	125 µsec.

Table 78
XMFE receiver specifications

Input sensitivity:	
accepted:	-4 dBm to -35 dBm ±10 Hz of nominal
rejected:	-42 dBm signals
rejected:	-4 dBmoutside 500–1900 Hz
rejected:	-40 dBmsingle/multiple sine wave in 500–1900 Hz
Bandwidth:	
accepted:	fc ± 20 Hz
Amplitude twist:	
accepted:	difference of 9 dB between frequency pair
Operating time:	< 64 msec.
Release time:	< 64 msec.
Tone Interrupt causing no release:	< 8 msec. Receiver on, tone missing
Longest Input tone ignored:	< 8 msec. Combination of valid frequencies
Longest control tone ignored:	< 15 msec. Control Frequency only
Noise rejection:	S/N > 18 dBNo degradation in-band white noise

Physical specifications

Table 79
The following table outlines the physical specifications of the NT5K21 XMFC/MFE circuit card.

Dimensions	Height: 12.5 in. (320 mm) Depth: 10.0 in. (255 mm) Thickness: 7/8 in. (22.25 mm)
Faceplate LED	Lit when the circuit card is disabled
Cabinet Location	Must be placed in the main cabinet (Slots 1–10)
Power requirements	1.1 Amps typical
Environmental considerations	Meets the environment of Meridian 1 systems

CIS Multifrequency Shuttle

The CIS Multifrequency Shuttle (CIS MF Shuttle) feature provides the existing Commonwealth of Independent States (CIS) Digital Trunk Interface with the ability to handle the Multifrequency Shuttle signaling protocol.

Prior to X11 Release 23, the two CIS-specific Digital Trunk Interface cards, the NTCG01AA (CDTI2) for Meridian 1 Options 51-81C and the NTCG02AA (CSDTI2) for Options 11E and 11C, met the CIS DTI2 signaling requirements and supported Dial Pulse signaling. The NTCG01/02AA are described in the *Intelligent Peripheral Equipment Circuit Cards for CIS* document. CIS MF Shuttle uses a combination of two out of six tones for Multifrequency Signaling between exchange connections. With CIS MF Shuttle, call setup time is reduced as a result of its faster transmission speed.

CIS MF Shuttle signaling is supported on two DTI cards: the NTCG01AB (CDTI2) and the NTCG02AB (CSDTI2). These cards are fully backward compatible with the X11 Release 21 CIS Digital Trunk Interface feature and can be used with Release 21 software with the same functionality as the NTCG01AA and the NTCG02AA cards.

CIS MF Shuttle supports the following common features:

— Multifrequency Shuttle signaling

— Buffered Dial Pulse signaling outpulsing performed by card firmware

— Dial Pulse signaling digit collection performed by card firmware

— Downloadable Dial Pulse speed and Make/Break ratio

— Cyclic Redundancy Check (CRC) multiframe format (allowed optionally)

— A-law/μ-law conversion

— Periodic Pulse Metering (PPM) when working in non-CIS mode

— Continuous Pulsing Detection (CPD) when working in non-CIS mode

— Expansion of the call types recognition mechanism based on the Special Service List (SSL) with the addition of a new call type - Special Service Unanswered Calls

— Man Machine Interface (MMI) port for debugging

— CIS digital trunks signaling (outgoing, incoming toll, and incoming local calls)

— Automatic Number Information (ANI) transmission on request from the Central Office (CO)

— Dial Tone to the calling party, after the Meridian 1 seizes an outgoing CIS trunk

— Special disconnect procedure (two-way release) providing Malicious Call Trace in CIS telephone network

— Unanswered free special service calls

— CIS transmission plan

— Downloading of the required firmware mode per loop-limited ordinary DTI2 or CIS DTI2

Sending and receiving digits

In order to meet the needs of CIS MF Shuttle signaling, two new SSL tables have been created: the ENBLOCK SSL table and the Flexible DN Size SSL table. These tables are implemented separately. When the outgoing trunk is idle, CIS MF Shuttle uses the ENBLOCK SSL table for ENBLOCK dialing. For incoming calls, the Flexible DN Size SSL table is used. The total number of SSL tables in the system has increased to 31 with the CIS MF Shuttle feature.

For outgoing CIS MF Shuttle trunks, the ENBLOCK Special Service List (SSL) table, in Overlay 18, is used to collect digits for optimal dialing operation. The ENBLOCK SSL table uses the number of digits dialed to determine the End of Dialing situation. It is recommended that **all** the possible numbers that can be dialed through the outgoing CIS MF Shuttle trunk be defined in the ENBLOCK SSL table. If an extra digit is dialed that has not been defined, the CIS MF Shuttle protocol considers the call a failure. Outgoing toll calls should be defined in the SSL table in Overlay 18 at the TOLL prompt. ENBLOCK signaling for outgoing toll calls remains active until all the toll access digits are dialed. The Special Service Digits combination (SSDG) field of the ENBLOCK SSL table should **not** include the outgoing CIS MF Shuttle trunk access code.

Table 80 provides an example of DN groups which may be included in a CIS CO dialing plan.

Table 80
Example of DN groups

DN Format	DN Length	DN Type
77XXXX	6	regular
95XXXXX	7	regular
6XXXXXX	7	regular
01	2	SSUC (Special Service Unanswered Call)
02	2	SSUC
03	2	SSUC
8...	1	Toll access code digit
Note: X represents any digit.		

Table 81 provides an example of the ENBLOCK SSL table for the outgoing CIS MF Shuttle route that would be defined based on the sample DNs described in Table 1. ENBLOCK SSL tables are defined in Overlay 18.

Table 81
Example of ENBLOCK SSL table

SSDG	**77**	**95**	**6**	**01**	**02**	**03**	**8**
CPDC	NO	NO	NO	NO	NO	NO	NO
TOLL	NO	NO	NO	NO	NO	NO	**YES**
ALRM	NO	NO	NO	NO	NO	NO	NO
TNDM	NO	NO	NO	NO	NO	NO	NO
SSUC	NO	NO	NO	YES	YES	YES	NO
NDGT	**6**	**7**	**7**	**2**	**2**	**7**	**1**

For incoming CIS MF Shuttle trunks, the DN size is defined as either fixed or flexible. The DN size is an important aspect of CIS MF Shuttle configuration because it determines the number of digits that are expected from the CIS CO for incoming CIS MF Shuttle routes. Therefore, entering the DN size is obligatory for all calls which originate from an incoming CIS MF Shuttle trunk. When the number of digits expected from the CIS CO is constant, and does not vary between different call types, then the DN size for the incoming CIS MF Shuttle route is fixed. Fixed DN size is defined at the DN Size DNSZ prompt in Overlay 16. For example, if it is known that for each incoming CIS MF Shuttle call the CIS CO dials four digits, then the fixed DN size would be defined as four at the DNSZ prompt in Overlay 16.

When the number of digits expected from the CIS CO varies from call to call, the DN size for the incoming CIS MF Shuttle route is flexible. If this is the case, it is necessary to define a separate DN size for each tandem direction. As introduced with the CIS MF Shuttle feature, flexible DN size is defined in relation to a DN prefix of up to four digits of the DN dialed by the CIS CO. Flexible DNs are defined using the Flexible DN size SSL table in Overlay 18. The table contains information on the number of DNs associated with each DN prefix. A DN prefix should be as short as possible while being explicit about the DN size. For example, if there is a tandem outgoing route with the access code "966" and it is the only DN that begins with the digit "9," then the DN prefix should be the single digit "9." If there is more than one DN type beginning with the same digit, one of the DNs should be defined using the single digit as a prefix and all the others should be defined using longer DN prefixes that allow for distinction between DN types.

As an example, assume that the following DNs may be received from the CIS CO via the incoming CIS MF Shuttle trunks:

— DNs in the 200-399 range are local Meridian 1 DNs

Tandem calls from the incoming CIS MF Shuttle trunk may be performed to the routes shown in Table 82.

Table 82
Example of DNs received from CIS CO

Outgoing tandem route number	Access code	DN length including the access code
1	4	5
2	5	6
3	6	7

As described in Table 82, five digits (including the outgoing tandem route access code) are expected when tandem calls from the incoming CIS MFS trunk to the outgoing route 1 trunks are originated. Six digits are expected for the outgoing route 2, and seven digits are expected for the outgoing route 3. Therefore, all the DNs which start with the digits 0, 1, 7, 8 and 9 are vacant.

The DN size for the incoming CIS MFS route cannot be defined as fixed because the route may receive DNs which contain 3, 5, 6 or 7 digits. Thus, the Flexible DN Size SSL Table for this route should be defined as described in Table 83.

Table 83
Example of a Flexible DN Size SSL table

SSDG	2	3	4	5	6
CPDC	-	-	-	-	-
TOLL	-	-	-	-	-
ALRM	-	-	-	-	-
TNDM	-	-	-	-	-
SSUC	-	-	-	-	-
NDGT	3	3	5	6	7

The information in the Flexible DN Size SSL table is added to the Route Data Block in Overlay 16.

Multifrequency Signals

For reference purposes, Table 84 defines forward and backward Multifrequency Shuttle protocol signals.

Table 84
MF Shuttle protocol signals

	Signal	Forward signals. A	Backward signal. B
1	700+900	Digit 1.	Send first digit of the called subscriber.
2	700+1100	Digit 2.	Send next digit.
3	900+1100	Digit 3.	Send previous digit.
4	700+1300	Digit 4.	The called subscriber is free.
5	900+1300	Digit 5.	The called subscriber is busy.
6	1100+1300	Digit 6.	Request of the previously sent digit received with mistake. (repetition).
7	700+1500	Digit 7.	Congestion signal.
8	900+1500	Digit 8.	Request to transmit the whole number in form of Dial Pulses.
9	1100+1500	Digit 9.	Request to transmit the remaining digits in Dial Pulse form.
10	1300+1500	Digit 0. (zero digit).	Request to transmit all digits, beginning with previously sent in the Dial Pulse form.
11	700+1700	Automatic call priority. (TOLL call only).	Request to send TOLL call category.
12	900+1700	Confirmation of the backwards signals: 4,5,8 9 and 10.	Spare.
13	1100+1700	Request to repeat the last signal.	Spare.
14	1300+1700	Automatic call no priority. (TOLL call only).	Spare.

Table 84
MF Shuttle protocol signals

	Signal	Forward signals. A	Backward signal. B
15	1500+1700	Operator call. (TOLL call only).	No information received.

Operating parameters

The functionality of Special Service List (SSL) tables has been expanded with the CIS MF Shuttle feature. The Number of Digits (NDGT) prompt is introduced in Overlay 18 to determine the number of digits which should be collected before the seizure of an outgoing CIS MFS trunk or received by an incoming CIS MFS trunk. The values provided in NDGT are used in the configuration of ENBLOCK or Flexible DN Size SSL tables. In addition, the total number of SSL tables in the system has been expanded to 31.

If a call starts in the MF Shuttle mode and ends in the Dial Pulse mode, it is necessary to test for proper Partial Dialing operation. Partial Dialing is unnecessary when the dialing is performed in MF Shuttle mode. MF Shuttle protocol fails when the incoming party issues a backward signal next digit request and the outgoing party has no more dial digits.

It is recommended that Auto DN trunks be defined with the DIP (Dial Pulse) Class of Service.

Feature limitations

The existing limitations of the CIS-specific Digital Trunk Interface cards still apply to CIS MF Shuttle. Therefore, as per existing functionality:

— The data in Automatic Number Identification (ANI) always refers to the first originator of the call. Thus, when a call is transferred the information provided in the ANI message does not correspond with the DN and ANI category of the set to which the call is transferred.

— On outgoing local calls, there is a 700 ms delay in the "Answer" signal recognition before the call is established. This delay is in addition to standard Meridian 1 answer validation timing.

— Data calls are not supported.

— Incoming and outgoing trunks should not be mixed within the same route.

— Toll Operator Break-In/Trunk Offer abilities are not supported.

— Toll Operator Manual Ringing capability is not supported.

Overlap signaling is not supported on outgoing MF Shuttle calls.

Auto Directory Numbers are not allowed in the MF Shuttle protocol.

30 MF Shuttle detectors are simultaneously available on the NTCG01AB CDTI2-MF Shuttle card, and 20 MF Shuttle detectors are simultaneously available on the NTCG02AB CSDTI-MF Shuttle card.

Dial Tone for incoming trunks is not supported by the CIS MF Shuttle feature.

Virtual Network Services are not supported for CIS MF Shuttle trunks.

Feature interactions

Automatic Redial

Automatic Redial (ARDL) receives B-Free/B-Busy information when making CIS MF Shuttle outgoing calls. In this situation, it is not necessary to connect a Tone Detector. If the call is terminated in the Dial Pulse mode, it is necessary to connect a Tone Detector for ARDL.

CIS Digital Trunk Interface

CIS MF Shuttle is based on the CIS Digital Trunk Interface feature. These two features are completely compatible.

Chinese #1 Signaling

The CIS MF Shuttle feature uses Chinese #1 Direct Dial Outward (DDO) to detect the End of Dialing situation. With the introduction of CIS MF Shuttle, End of Dialing conditions are detected with the ENBLOCK SSL tables, as well as the methods already used by Chinese #1 Signaling.

NARS

Network Alternate Route Selection (NARS) has its own ENBLOCK dialing processing. Outgoing local CIS MF Shuttle trunks also require and perform ENBLOCK dialing. Thus, for outgoing NARS calls through CIS MF Shuttle trunks, the following conditions must be met:

— NARS must be configured with the Flexible digit number (FLEN) equal to the maximum possible length of the dial number.

— Inhibit Timeout Handling (ITOH) must be set to NO to allow a call to be attempted after the NARS Interdigit Number (NIT) timer in Overlay 15 has expired (even if fewer digits than the FLEN capacity have been dialed).

— The ENBLOCK SSL table should include only the DNs which have to be sent to the CIS Central Office (CO). For example, DNs which are generated after the NARS translation of the dialed number.

For incoming CIS MF Shuttle calls, the NARS call processing is activated only after all the dialed digits are received from the CIS CO. When the Fixed DN size is used to define the expected number of digits, there is no interaction with NARS. When the Flexible DN size feature is used to define the expected number of digits, the Flexible DN size SSL table must be defined to include DNS which are received from CIS CO. DNs which are generated after the NARS translation are not to be included in the Flexible DN size SSL table.

Networking Features

Only B-Free and B-Busy condition transmitting and receiving are supported. CIS MF Shuttle supports B-Free/B-Busy networking interactions with the following signaling protocols:

— R2/MFC

— ISDN (DPNSS, QSIG, EuroISDN, and MCDN)

— CIS MF Shuttle

— CIS Dial Pulse DID and CO

Incoming CIS MF Shuttle trunks only accept the networking information from the trunks which support the Direct Inward Dial (DID) gateways and the CIS Dial Pulse outgoing CO trunks. Outgoing local CIS MF Shuttle trunks may pass the B-Free/B-Busy networking information to the R2/MFC, ISDN, CIS MF Shuttle and CIS Dial Pulse DID trunks.

Feature packaging

CIS MF Shuttle (CISMFS) is package 326. The following packages are also required:

— Flexible Tones and Cadences (FTC) package 125

— 2 Mbps DTI (DTI2) package 129

— Supplementary Features (SUPP) package 131

Note: The required Chinese #1 DDO is included in package 131.

— Flexible Numbering Plan (FNP) package 160

— CIS Digital Trunk Interface (CIST) package 221

Feature implementation

LD 73 – Configure the NTCG01AB (CDTI2)/NTCG02AB (CSDTI2) card to support both MFS and Dial Pulse protocols.

Prompt	Response	Description
REQ	CHG	Change existing data.
TYPE	DTI2	2.0 Mbps DTI2 Data Block.
FEAT	LPTI	Loop Timers.
LOOP	0-159 0-9	DTI2 loop number. For Option 11C.
CDTI2	YES	CDTI2/CSDTI2 Card.
...		
CISFW	MFS	Multifrequency Shuttle. This will enable both the CIS Dial Pulse and the CIS MFS signaling protocols on the NTCG01AB/NTCG02AB card. DP = Dial Pulse CIS signaling protocol on the NTCG01AA/ NTCG02AA card. NO = Non CIS DTI2 signaling protocols on the NTCG01AB/NTCG02AB or NTCG01AA/NTCG02AA card (default).

LD 18 – Configure MF Shuttle call type handling.

Prompt	Response	Description
REQ	CHG	Change existing data.
TYPE	SSL	Special Service List.
SSL	1-31	Special Service List number.
SSDG	0-9999	Special Service Digits combination.
NDGT	(0)-15	Number of digits which should be collected before seizure of the outgoing CIS MFS trunk or recognition by an incoming CIS MFS trunk. This information comes from the ENBLOCK SSL table or the Flexible DN size SSL table. If the outgoing call is recognized as an MFS call, then the trunk is not seized until the number digits dialed by the user is equal to the NDGT, or the End Of Dialing timer expires, or the OCTO (#) is dialed. If the incoming call is recognized as an MFS call, then the trunk is requested to issue the backward MFS signal to the CIS CO party until the number of digits accepted from the trunk is equal to the NDGT.

LD 16 – Configure CIS MF Shuttle feature in the Route Data Block.

Prompt	Response	Description
REQ	CHG	Change existing data.
TYPE	RDB	Route Data Block.
CUST	xx	Customer number.
ROUT	0-511 0-127	Route number. For Option 11C.
TKTP	DID COT	Direct Inward Dialing. For the incoming trunk route. Central Office Trunk. For the outgoing trunk route.
...		

ICOG	ICT OGT	Incoming only trunks. Outgoing only trunks. MFS routes can be either only incoming or only outgoing.
...		
MFC	CMFS	CIS MFS route. This response is allowed only if both the CIST package 221 and CISMFS package 326 are equipped.
MFSS	(B1) B2 B3	The MFS protocol Start signal. This prompt appears only for incoming CIS MFS routes.
TCRS		The Toll Category Request Supported option is defined for the incoming TOLL CDTI2-MFS routes. The TCRS is prompted only if the MFC is set to CMFS for the incoming routes only.
	(YES) NO	The Toll Category Request is supported (default). The CIS TOLL exchange does not support the TOLL Call Category Request MFS signal (B11).
CNTL	YES	Change controls or timers.
TIMR	DDL 0	Delay Dial Timer not needed.
TIMR	DSI 5000	Disconnect supervision timer - 5 sec value.
TIMR	EOD 14000	End of dial timer for DP originator.
TIMR	ODT 14000	End of dial timer for DTN originator.
TIMR	SFB 25	Seize Fail Busy timer. The recommended value for trunks when seizure supervision is 25 seconds.
TIMR	GTI 128	Incoming Guard timer should be defined with minimum (**not** zero) value.
TIMR	ATO 30000	ANI delay timer should be defined for CIS outgoing trunk routes with 30000 - 50000 ms (30 - 50 sec) value. If the Local Exchange to which the outgoing trunk is connected does not perform the ANI interaction immediately after dialing the Toll access code, the ATO should be defined with the minimum value of 128 ms.
DDO	YES	Delayed Digit Outpulsing must be set to YES for outgoing CIS MFS trunks.

...		
SSL	1-31	The SSL Table number must be defined for both incoming and outgoing routes. For incoming routes, choose to define either the Flexible DN Size or the Fixed DN Size. Only one type of definition is supported per route.
...		
DNSZ	1-7	For the incoming trunks only. The Fixed DN Size can not be used together with the Flexible DN Size.
...		

LD 14 – Configure CIS MF Shuttle trunks.

Prompt	Response	Description
REQ	CHG	Change existing data.
TYPE	DID COT	Direct Inward Dialing. For incoming trunks. Central Office Trunk. For outgoing trunks.
TN	l ch c u	Loop and channel for digital trunks. l = loop 0-159 and ch = channel 1-30 for 2.0 Mbps DTI. Card 1-9 for Option 11C.
CLS	CMFS	CIS MF Shuttle protocol is supported by the trunk. CMFS may be defined only for trunks on the CDTI2/CSDTI2 cards with "CDTI2=YES" and "CISFW=MFS" and only if both the CISMFS package 326 and the CIST package 221 are equipped. Each trunks member of the CIS MFS route can be defined as CFMS or DIP or DIPF.

Feature operation

No specific operating procedures are required to use this feature.

Option 11 & Meridian 1

Intelligent Peripheral Equipment Circuit Cards for CIS

Description and installation

© 1995,1997 Northern Telecom
All rights reserved
Information is subject to change without notice. Northern Telecom reserves the right to make changes in design or components as progress in engineering and manufacturing may warrant. This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC rules, and the radio interference regulations of Industry Canada. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy, and if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at their own expense.
SL-1 and Meridian 1 are trademarks of Northern Telecom.
Publication number: P0875866
Document release: Standard 3.00
Date: October 1997
Printed in Canada

NORTEL
NORTHERN TELECOM